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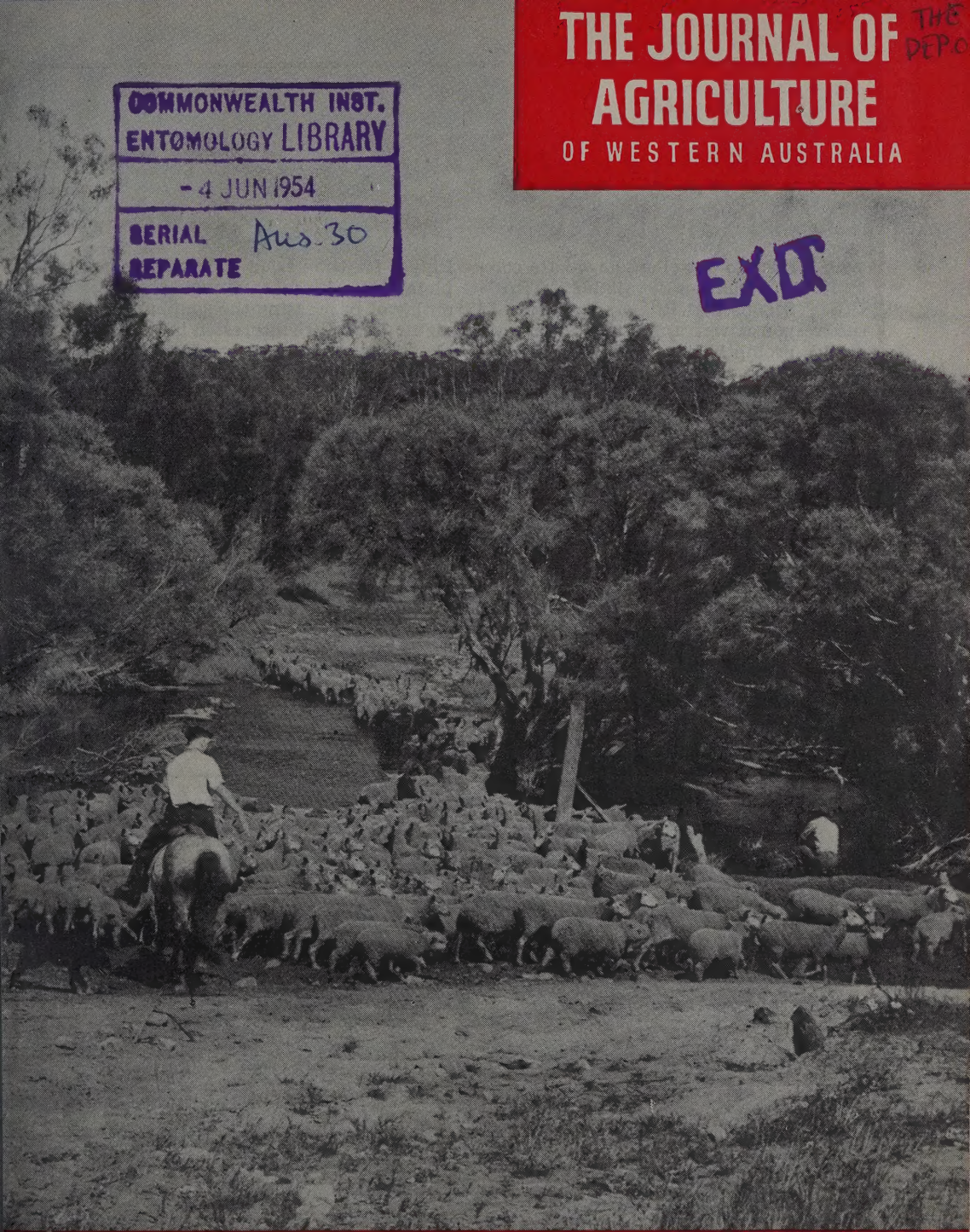

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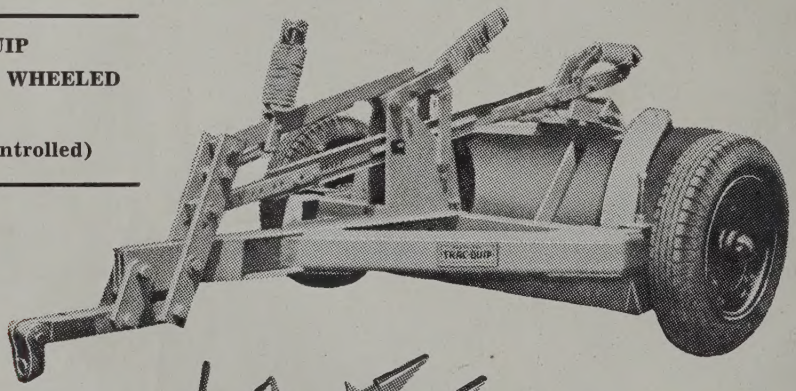

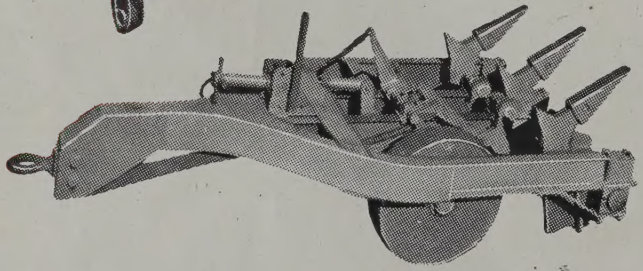

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WESTERN AUSTRALIA

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COVER PICTURE

Portion of the Muresk Agricultural College flock of Border Leicester x Merino crossbred ewes with Southdown-sired lambs at foot. The flock is fording the Avon River which flows past the College paddocks.

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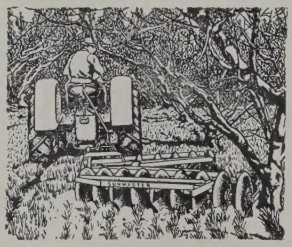

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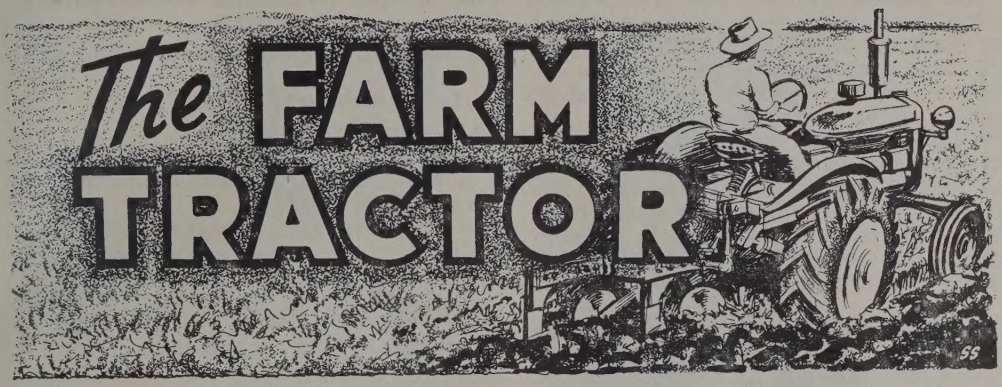


Part 1.—How the Engine Works

NO driver can look after his tractor properly unless he knows something of the way it works. The modern tractor is a sturdy machine designed to stand continuous hard work, but it contains a certain amount of complicated mechanism. All drivers, therefore, should know enough of the working principles of a tractor to be able to undertake the "maintenance" of the one they use.

If through neglect or ignorance a tractor does not get proper maintenance—

1. It will never be capable of undertaking its full duty.
2. Repair bills will be heavy.
3. It will break down, generally at busy times.
4. Its working life will be considerably shortened.
5. Fuel will be wasted.

In the long run the only complete guide to the maintenance of a tractor is the instruction book issued by the makers. The instruction book is the most valuable part of the tool-kit supplied with a new tractor.

The letterpress and illustrations in this series of articles are from a handbook prepared by the National Institute of Agricultural Engineering (England) and are reproduced by courtesy of the Institute and the British Ministry for Agriculture and Fisheries.

Any owner who has no instruction book for his own particular model would do well to order one. But the information given therein may be rather too detailed and too technical for the new-comer to tractor work to grasp at all readily. Moreover, there is an instruction book for every single model, and the maintenance instructions given for one are not always a safe guide to the maintenance of another. These articles have been written, not to replace the instruction book, but to give beginners in particular, and even in some cases "old hands," an insight into the construction and use of tractors in general. Thus they may more easily understand the detailed instructions given by the makers of the tractor they have to operate.

THE INTERNAL COMBUSTION ENGINE

The kind of engine used in a tractor is called an internal combustion engine because it converts the heat energy of fuel into mechanical work by burning the fuel inside the engine itself.

A steam engine, for example, is not an internal combustion engine because the engine part of it—cylinder, piston and so on—is quite distinct and separate from the fire-box in which the fuel is actually burnt. The fuel burnt in an I.C. engine can be any one of the following:—Coal or producer gas, petrol or kerosene vapour, or diesel oil in the form of a finely-atomised spray.

The general principle of all I.C. engines is the same and depends on the fact that air combined in the right proportion with any one of these fuels will form an explosive mixture. The various types of engine differ from one another only according to the fuel used, the exact arrangements for introducing and exploding it, and the number of cylinders. For tractors the most common and important type is the four-stroke engine starting on petrol and running on a special kind of kerosene known as vapourising oil.

Fig. 1 shows a diagram of a four-stroke I.C. engine cut across the middle, and viewed from the end. All the most important parts are labelled, and will be referred to throughout this book by these names.

THE SINGLE CYLINDER FOUR-STROKE ENGINE

The cycle of operations is shown in Fig. 2.

1. **Induction Stroke.**

(a) The inlet valve opens.

(b) The piston moves down the cylinder.

(c) Fuel and air mixture is sucked into the cylinder.

(d) When the piston reaches the bottom, the cylinder is full of explosive mixture and the inlet valve closes.

2. **Compression Stroke.**

(a) Both valves are closed.

(b) The piston rises.

(c) The mixture in the cylinder is compressed into a much smaller space.

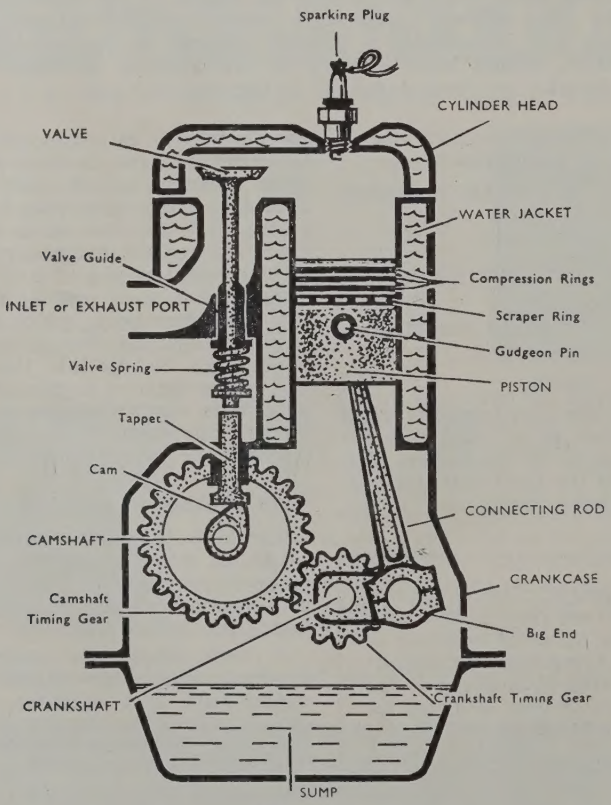


FIG. 1
THE 4-STROKE ENGINE

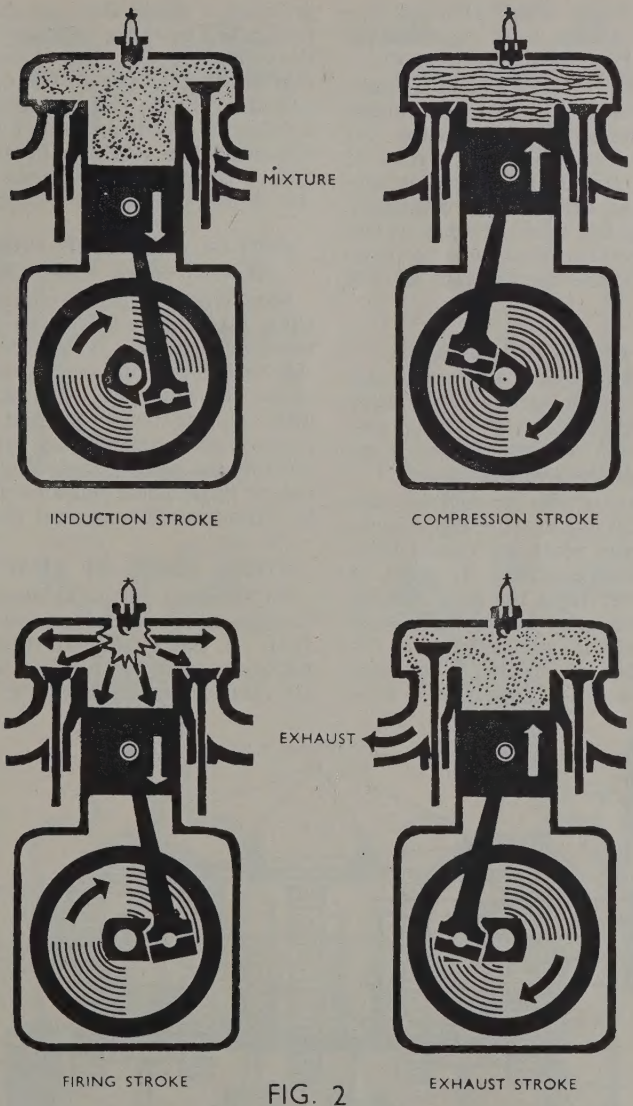


FIG. 2

3. **Firing Stroke.**

(a) At the end of the compression stroke both valves are still closed.

(b) As the piston reaches the top of this stroke a spark at the sparking plug ignites the compressed mixture.

(c) The force of the explosion of that mixture drives the piston down the cylinder.

4. **Exhaust Stroke.**

(a) The exhaust valve opens as the piston reaches the bottom of the firing stroke.

(b) The piston moves up the cylinder again.

(c) The burnt gases are driven out past the exhaust valve.

(d) The exhaust valve closes.

Then once more the inlet valve opens—fresh mixture is drawn into the cylinder and the whole cycle starts over again.

An engine of this kind is called a four-stroke engine because, as indicated above there are four strokes of the piston for each explosion. The explosion stroke is the only working stroke, i.e., the only one in which the piston drives the crankshaft. During the remaining three strokes of the cycle the crankshaft continues to turn round because of the momentum of the flywheel.

THE FOUR-CYLINDER ENGINE

Smoother running and a more uniform output of power will obviously result from using several cylinders with the corresponding pistons all coupled to the same crankshaft as indicated in Fig. 3.

The vast majority of tractor engines have four cylinders working on the above principle, i.e., they have what are called four-cylinder four-stroke engines. In such an engine one cylinder fires for each stroke: that is, two cylinders fire during each complete revolution of the crankshaft and flywheel. The order of firing in a four-cylinder four-stroke engine is either 1-3-4-2 or 1-2-4-3 depending on the make of the tractor. The more common is 1-2-4-3: but the firing order will usually be found marked somewhere on the engine. A four-cylinder engine runs smoothly and gives a fairly uniform output of power because, whatever the position of the crankshaft, one or other of the pistons is actually on the firing or "working" stroke.

PETROL STARTING FOR TRACTORS RUNNING ON VAPOURISING OIL

Most tractors in this country use vapourising oil (kerosene) as fuel because it is relatively cheap. But a tractor cannot be started from cold on vapourising oil because this fuel will not turn into vapour until it has been warmed up. For this reason all vapourising oil tractors are started on petrol and should be run on petrol until their engines are hot enough to vapourise the normal fuel properly.

OTHER KINDS OF TRACTOR ENGINE

In America petrol is cheaper than it is here so it is more often used as a tractor fuel. A petrol-air mixture can be more highly compressed than a vapourising oil-air mixture without giving trouble on the

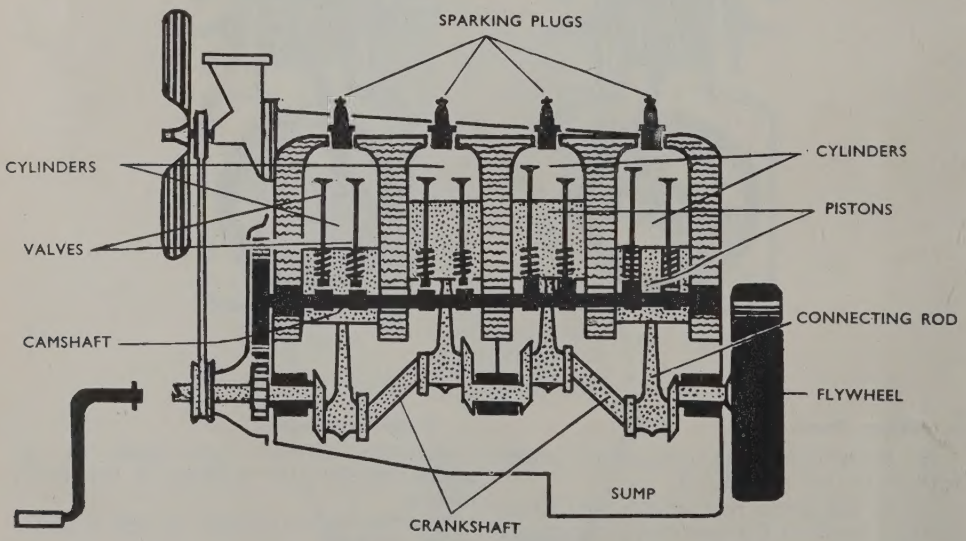


FIG. 3

THE 4-CYLINDER ENGINE

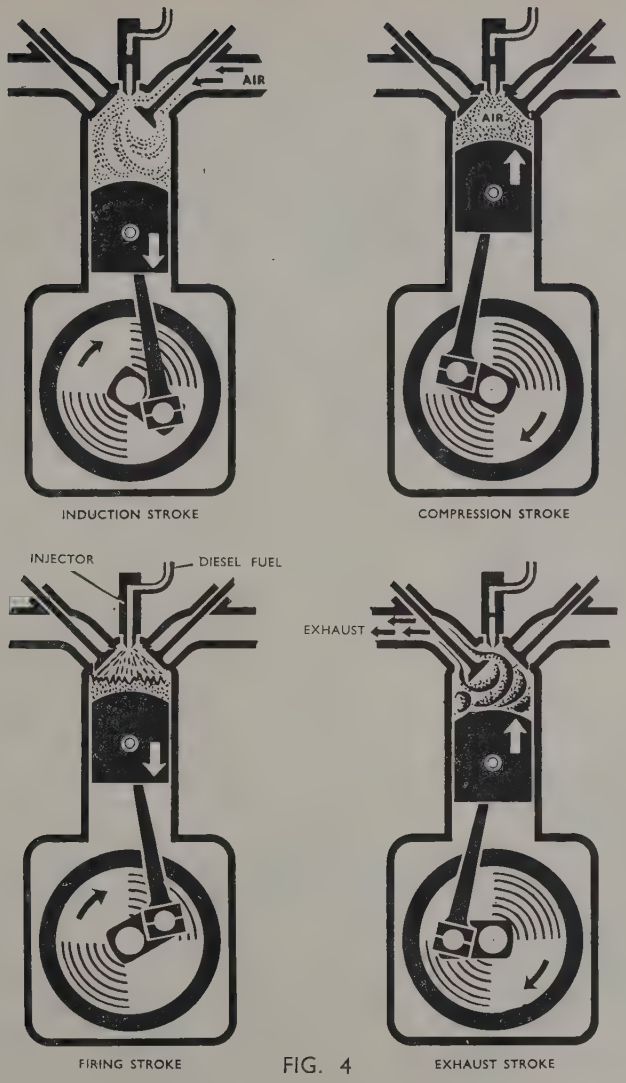


FIG. 4

THE DIESEL CYCLE

firing stroke: or, as we generally say, an engine running on petrol can have a higher compression ratio than an engine running on vapourising oil. With a higher compression ratio more power can be obtained from the same size of engine, and so, if it has been specially designed for the purpose, a petrol engine will generally be more powerful than a vapourising oil engine of the same size.

THE DIESEL ENGINE

In some parts of the world vapourising oil is either expensive or difficult to obtain, and the only cheap fuel is diesel oil. In those places tractors with diesel engines are popular; some tracklaying tractors of this type are also to be found in this country. The diesel engine works on the same principle as the vapourising oil engine, but there is no sparking plug and

fuel is not introduced until the end of the compression stroke (see Fig. 4). The cycle is as follows:—

1. **Induction Stroke.**—The inlet valve opens—the piston goes down, drawing in pure air—the inlet valve closes.

2. **Compression Stroke.**—Both valves are closed—the piston comes up and compresses the air in the cylinder. The engine has a high compression ratio and on this stroke the air is compressed so much that it get hot—as it does in a bicycle pump when a tyre is being inflated.

3. **Firing Stroke.**—As the piston reaches the top of the compression stroke a spray of diesel fuel is shot into the cylinder through a nozzle called an injector. The heat of the compressed air is sufficient to ignite the fuel, causing an explosion which drives the piston down.

4. **Exhaust Stroke.**—The exhaust valve opens and as the piston comes up the burnt gases are driven out of the cylinder. The exhaust valve then closes and the cycle starts again by drawing in fresh air.

Most four-stroke diesel engines can be started from cold but their high compression ratio makes them difficult to turn by hand, and they often have auxiliary starting devices. Thus some diesel-engined tractors have a small petrol engine for starting them, while others are arranged so that they can start on petrol, and operate as ordinary petrol engines until they warm up.

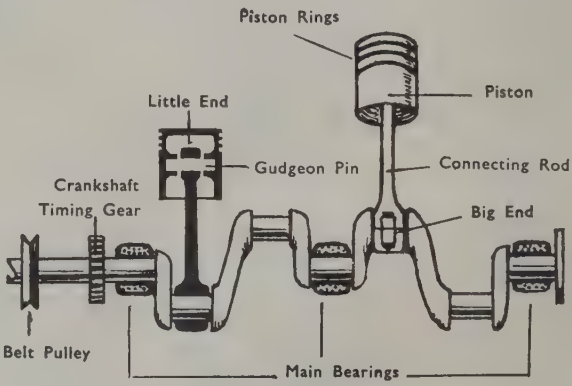


FIG. 5 THE CRANKSHAFT

TRACTOR COMPONENTS

This section aims at showing how the principles of the internal combustion engine are put to practical use in a tractor.

THE TRACTOR ENGINE

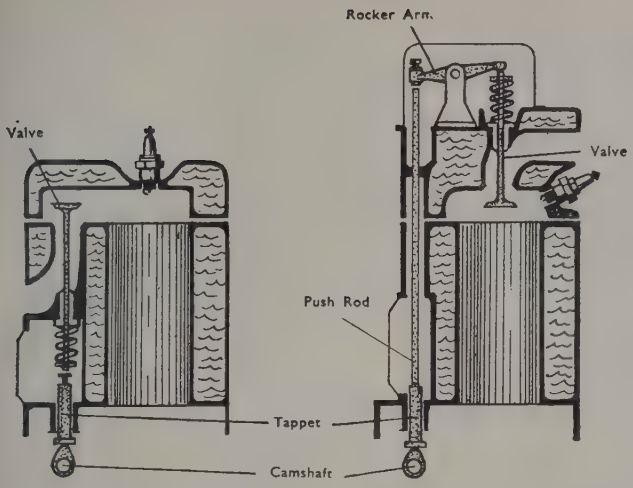
The piston must make a gas-tight joint with the inside wall of the cylinder and yet be free to move up and down. This gas-tight fit is obtained by three or more cast-iron rings (piston rings) which are let into grooves around the piston. The rings tend to spring outwards and so project slightly from the piston and press against the cylinder wall.

The connecting rod is connected to the piston by the gudgeon pin, which passes through the little-end bearing in the connecting rod and is supported at each end in the wall of the piston. The end of the connecting rod attached to the crankshaft is called the big-end bearing and is in two parts bolted together round the crankshaft.

The crankshaft, like the pedal and crank of a bicycle, turns the up-and-down motion of the piston into rotary motion, which can be used to drive the tractor wheels. The crankshaft itself is carried in bearings known as main bearings—in a four-cylinder engine there can be two, three or five main bearings, three being most common.

The valves are generally of the poppet or mushroom type consisting of a mushroom-shaped head on a central stem. They move up and down in "sleeves" called valve guides and are held in the closed position by valve springs. There are two common arrangements—side valves and overhead valves as shown in Fig. 6. Practically all tractors, except the Fordson, have overhead valve engines. In tractors, overhead valves are operated by push rods from a camshaft at the side of the engine.

The Camshaft.—The valves are opened and closed at the correct times by means



SIDE VALVE

OVERHEAD VALVE

FIG. 6

of cams, which are merely projections from the camshaft. The setting of the camshaft is of great importance in the running of the engine. On this will depend the valve timing, that is, the exact moments at which the valves open and close.

The Carburettor.—As the piston descends, a stream of air is drawn over a small hole called the jet from which it picks up some fuel and carries it on into the cylinder. The jet is fed from the fuel tank through a fuel chamber containing a float. If more fuel enters the float chamber than the engine needs, the float will rise until the valve at the top closes the pipe from the tank. When the engine needs more fuel, the float will fall and allow more to enter the float chamber. The quantity of fuel reaching the jet is controlled by the setting of a needle valve (see Fig. 8).

The Vapouriser. — When petrol is used, the fuel picked ourises, i.e., turns into gas. up from the jet rapidly vap- Such a mixture of air and petrol vapour explodes easily. Vapourising oil does not turn into gas unless it is heated. It leaves the jet as a very fine spray made up of small drops of fuel, which must then be heated in a vapouriser to turn them into gas.

The vapouriser is a narrow box, one side of which is heated by the hot gases leaving the engine on each exhaust stroke. When the engine has been running for a short time on petrol the vapouriser becomes hot. If the engine is then turned on to vapourising oil, the spray of fuel from the jet will be heated and turned into a gas, which forms with air an easily exploded mixture (see Fig. 8).

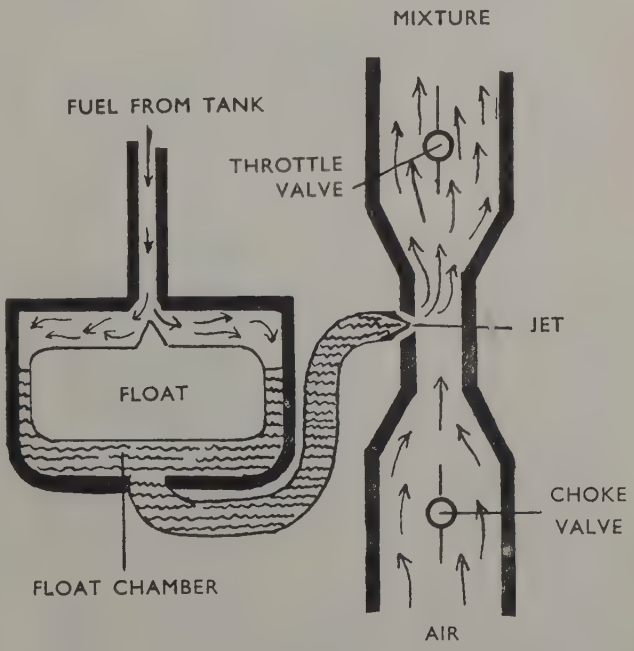


FIG. 7 THE CARBURETTOR

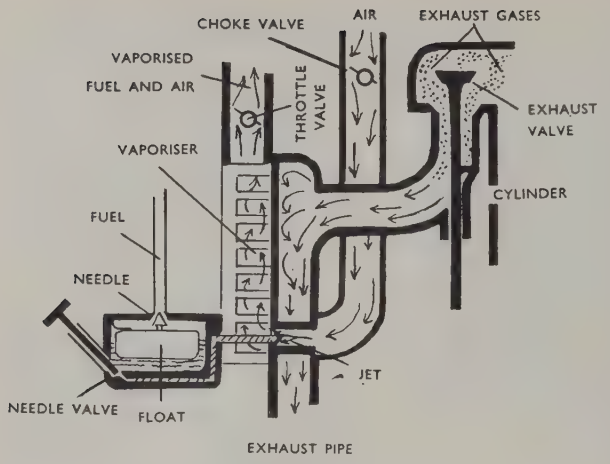


FIG. 8 THE VAPORISER

The Throttle is shown in Figs, 7 and 8. It is a flat disc of metal which can be set so that it partially blocks the induction pipe, i.e., the pipe along which the fuel-air mixture flows to the engine. The speed and power of the engine are controlled by the amount of mixture that the throttle allows to enter the cylinders. In Fig. 7 the throttle is open, in Fig. 8 it is closed.

The Choke.—The engine requires a "rich mixture" for starting, i.e., more petrol vapour in the mixture than is needed for normal running. For this reason another disc, similar to the throttle, is placed in the air intake so that the air has to flow past it before reaching the jet. Normally this disc—called the choke—is wide open, but for starting it is partially closed to restrict the flow of air and make the mixture rich in petrol. It is shown in the two diagrams—in the top one it is open for normal running and in the bottom one it is partially closed for starting, i.e., the engine is "choked."

The Governor is an automatic device which keeps the engine running at the same speed whether the load is heavy or light. The governor control allows the driver to alter the speed at which the governor keeps the engine running. If the load on a tractor increases so that the engine speed tends to fall, the governor opens the throttle and gives the engine more fuel. When the load decreases so that the engine tends to speed up, the governor closes the throttle and cuts down the fuel supply.

The Magneto produces the spark at the sparking plug which fires the mixture in the cylinders. It is a small dynamo and induction (or "shocking") coil combined. When the end cover is taken off, the inside will look something like the diagram in Fig. 9. This shows the moment at which a spark is produced at the sparking plug in No. 1 cylinder. A spark is produced whenever the points of the contact breaker open, which occurs each time the end of the rocker arm passes the cams on the stationary cam ring. The spark appears at No. 1 plug because the rotor arm of the distributor is passing the end of No. 1 plug-lead. In the magneto shown, this rotor arm is geared to revolve at half the speed of the contact breaker, so that when the points next open the rotor arm of the distributor will be opposite No. 2 pluglead. The magneto must be "timed" so that the points open, i.e., the spark occurs, in the right cylinder and at the right time in relation to the position of the piston at the end of each compression stroke.

A Sparking Plug is the means whereby the mixture is ignited in the cylinder by a spark appearing at the gap between its points. Sparking plugs must be kept clean and in good order or the spark they give will be weak. In that case the mixture will not be ignited properly: starting will be difficult and power will be lost.

It is most important, therefore, that plugs should be taken out periodically and cleaned thoroughly.

Not all sparking plugs are alike, and, whenever possible, the particular type of plug recommended by the makers of a tractor should be fitted.

The Impulse Starter is a device which makes tractors easier to start. When turned slowly a magneto gives a weak spark that makes starting difficult, so while the engine is being turned slowly some means has to be found to increase the magneto

SPARKING PLUGS

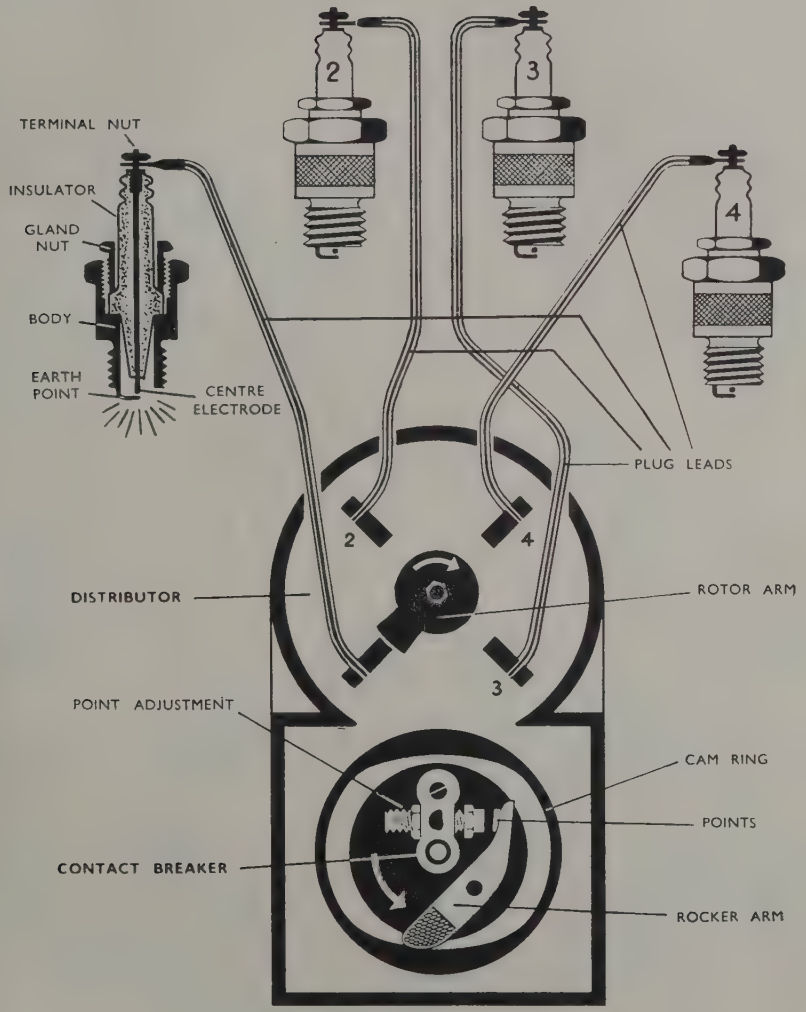


FIG. 9 THE MAGNETO

speed. When the engine is turned the impulse starter prevents the magneto from turning with it until the piston reaches the top of the compression stroke. At this moment the magneto is released, and is driven round at high speed by a spring so that it delivers a "fat" spark. The spark thus produced by hand-turning is as good as the spark delivered in normal running at normal engine speed. The impulse starter engages automatically when the engine stops and can be heard to "click" as the engine is turned over by hand. As soon as the engine starts it disengages itself automatically. Any modern tractor can therefore be started simply by pulling up the starting handle.

The Lubrication System can be one of the following:—

1. **Splash.**—The big-ends dip into trays carrying oil in the sump, and so cover the inside of the engine with oil.

2. **Pressure Feed.**—Oil drawn from the sump through a screen is pumped through pipes to every part of the engine (see Fig. 10).

3. **Force Feed and Splash** is a combination of the above. Usually the big-ends, little-ends and piston are lubricated by splash and the rest of the engine by a pump feed.

Few tractors nowadays have splash lubrication systems. Most of them are wholly or partly pressure fed and a gauge is fitted to show that oil is circulating. This should be watched during work and the engine stopped at once if no pressure is showing on the dial. In addition, an oil filter may be fitted to keep the oil free from contamination. This filter should be cleaned or replaced periodically as the makers advise in the instruction book.

The diagram (Fig. 10) shows a typical pressure-fed lubrication system. After

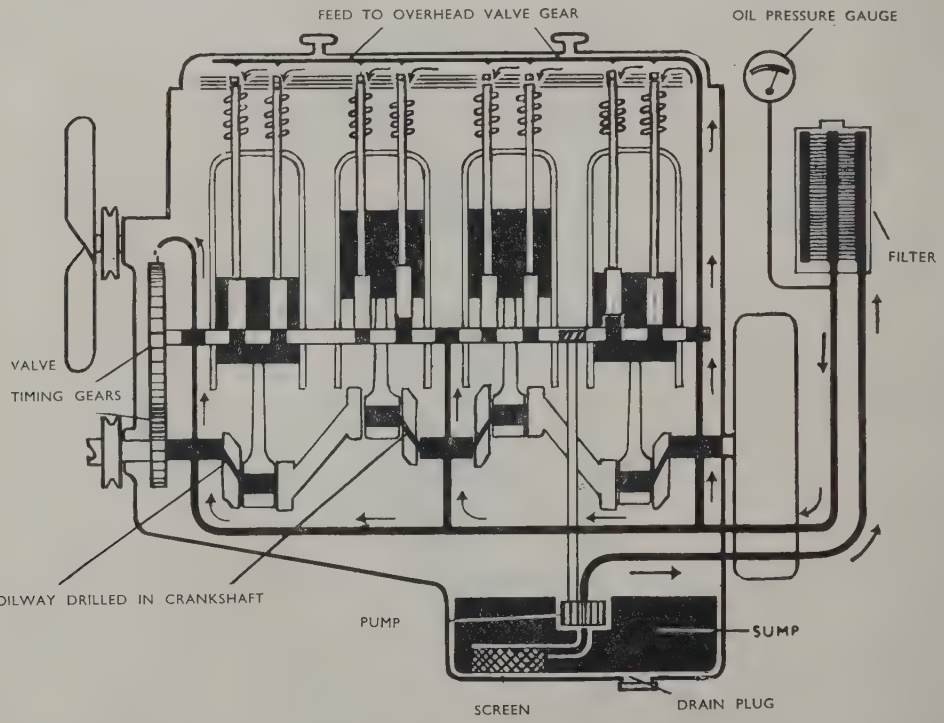


FIG. 10 A FORCE FEED LUBRICATION SYSTEM

being pumped through a filter the oil is carried by pipes to the various bearings, reaching the big-ends through oil-ways drilled in the crankshaft. In the drip feed to the overhead valve gear, the oil finds its way down the push rods and tappets to lubricate the cams before returning to the sump. Lubrication of the cylinder walls and little-ends is effected by splash from the crankshaft and by oil-mist.

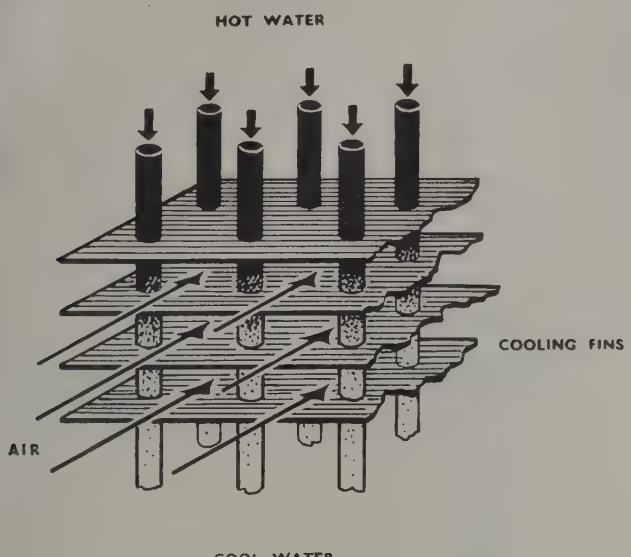


FIG. 11 RADIATOR SECTION

The Cooling System.—An internal combustion engine, with its large number of explosions per minute in each cylinder, needs some cooling device to prevent damage by excessive heat. Water is used, and the usual method of cooling is by the thermo-syphon system. In this system the water circulates because hot water is lighter than cold. Hot water from the parts of the engine nearest to the cylinders rises and passes through a pipe to the top of the radiator. The radiator is a series of tubes with fins, through which air is drawn by the fan. As the water is cooled in the radiator it becomes heavier, falls to the bottom and passes to the lower part of the cylinder jacket, to replace the warm water leaving at the top.

It is usual on tractors to have a pump or impeller at some point in the circuit to assist the circulation and improve the efficiency of the cooling.

In practice, tractors running on vapourising oil tend to keep cool, especially on light loads. In a cool engine the fuel is not completely vapourised, with the result that maximum power is not developed and unburnt fuel passes the pistons to the lubricating oil in the sump with harmful effect. There are three main methods of controlling the engine temperature:—

1. Radiator blinds.
2. Radiator shutters.
3. A thermostat controlling the pump circulation.

1 and 2 are most satisfactory when used in conjunction with a thermometer, which can be read from the

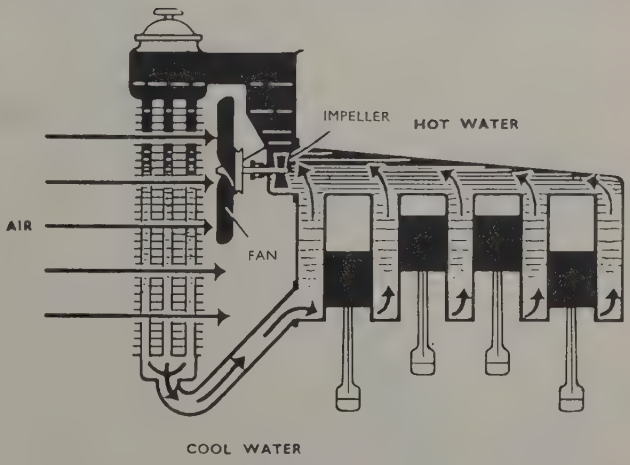


FIG. 12
THE COOLING SYSTEM

driver's seat. The thermometer is best fitted near the top of the radiator, where the water should be kept just under boiling point. Radiator blinds can be raised to keep the engine warm for starting or during cold weather and periods of light loading, and lowered for warmer weather or heavy loads.

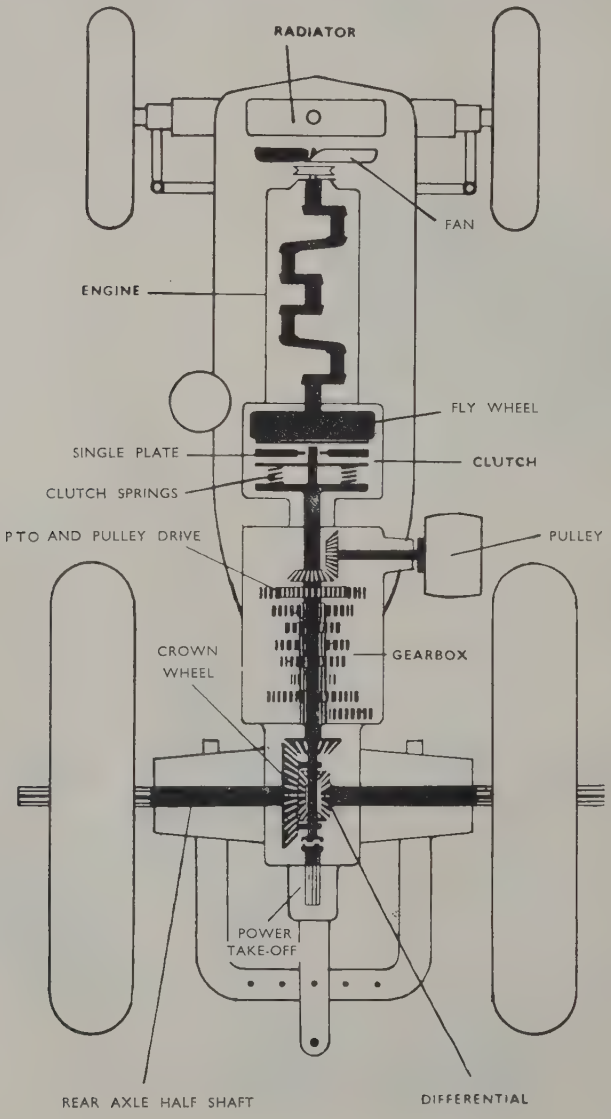


FIG. 13 THE TRANSMISSION SYSTEM

Radiator shutters are opened and closed by a hand lever from the operator's seat.

Some tractors use a valve called a thermostat which is fitted between the top of the cylinder and the radiator. When the water round the cylinders is hot enough, this valve opens and allows the water to flow to the radiator for cooling.

THE TRANSMISSION SYSTEM

The transmission system of a tractor is divided into three parts:—

1. **The Clutch** may be one of two types:—

(a) Single plate.

(b) Multiple plate.

The single plate clutch is the more common in modern tractors. It consists of one plate held tightly between two surfaces by powerful springs. One of these surfaces is usually on the engine flywheel, the other is attached to the shaft which drives the gearbox and back axle. Pressing on the clutch pedal, parts these two surfaces so that the plate is free, and the gearbox is no longer driven by the engine. Releasing the pedal allows the clutch springs to clamp the plate between the two surfaces, and so to connect the engine to the gearbox. Single plate clutches are fitted in a separate compartment in the transmission system where no oil can reach them and are known as dry clutches. The multiple plate clutch consists of a number of plates, half which are driven by the engine and half fixed to the shaft driving the gearbox. These plates are arranged alternately—one engine driven, then one that drives the gearbox and so on. When the clutch pedal is depressed the plates are allowed to spread, so that they do not touch and drive each other. In the same way when the pedal is released the clutch springs clamp the plates together, and the engine drives the gearbox. Multiple plate clutches are usually fitted in a part of the transmission to which the engine oil can penetrate and thus, running in oil, are known as wet clutches.

2. **The Gearbox** gives a choice of tractor speeds so that the power of the engine may be used to the best advantage, and the speed chosen for each farming operation. The gearbox is designed to allow gear changes only when the tractor is stationary, and the gears should not be changed while the tractor is moving.

3. **The Back Axle** is the final drive from the gearbox to the rear wheels. It consists of two half shafts and a differential gear which enables the driving wheels to turn at different speeds when going round corners.

(To be continued)

BEEHIVE REGISTRATION

THE Director of Agriculture (Mr. G. K. Baron Hay) wishes to remind all beekeepers that under the Bees Act, 1930-1950, any person keeping bees must be registered for the current year, the period of registration ending on December 31, annually.

Persons owning hives of bees who have not previously registered are required to pay a registration fee of 2s. 6d. for any number of hives up to 25. A further fee of 1s. should be paid for each additional 25 hives or lesser numbers in excess of the first 25. Persons registering for the first time as beekeepers are also required to take out a registered brand for which a further fee of 7/6 is payable.

Beekeepers who have previously registered must re-register and are reminded that re-registration fell due on January 1, 1954.

In applying for registration or re-registration, beekeepers should forward the full name, address, and particulars of location. Country applicants should add exchange to cheques drawn on country bank branches.

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FOOTROT IN SHEEP

Part 2—The Need For Summer Treatment

(Contributed by the Veterinary Branch)

OWING to the recent intensification of the campaign against footrot instigated by the Veterinary Branch of the Department of Agriculture, most flockowners are now familiar with the symptoms of the disease as manifested during the wetter periods of winter and spring.

During the periods when lush green feed is abundant, footrot soon advertises its presence in a flock. Wet ground softens the hooves and the skin of the feet so that the organisms responsible for footrot find it easy to gain entry to the tissues where they multiply and produce severe lameness.

During the dry summer months conditions are not conducive to a spread of the disease however. The hooves harden, and many mild cases of footrot will cure themselves, for the organisms require moisture to enable them to survive and multiply.

Although a flock may contain a percentage of badly-infected feet, the chances of spreading the infection during dry, hot weather are comparatively slight.

Even where infected material from the diseased feet is left on the ground, the organisms are unlikely to survive long enough to spread the infection. Hot dry weather shortens the period during which the organisms can survive away from the host animal, and in any case, the majority of the hooves in the flock are now adequately protected against infection by sound, hard horn and dry healthy skin.

As a result of these natural controls, lameness caused by footrot may become scarce or non-existent during the summer and the farmer is apt to relax his vigilance and congratulate himself on having "cleaned up" his flock.

With the advent of the wet weather, however, the chances are that he will again find himself fighting footrot. With his property still quarantined, and his flock still containing lame sheep which spend their time lying down instead of grazing, he will be apt to subscribe to the once-popular belief that the footrot organisms, when once introduced into a property, will exist in the soil for many years.

This of course is a fallacy that has been convincingly disproved on many occasions. Under the most favourable

Fig. 1.—Because its footrot-infected feet made standing painful, this sheep spent much of its time lying down. A sore formed on the brisket through prolonged contact with the ground and this became infected, producing an abscess.

conditions the footrot organisms will not survive in the soil for more than about seven days. Consequently, if the paddocks have not carried sheep for 14 days, the flockowner can count on an ample margin of safety from infection.

"CARRY-OVER" INFECTIONS

How then is the organism able to infect the flock in the winter when all the sheep were apparently footrot-free during the previous summer?

The answer is found in the word "apparently". Some, at least, of the sheep which appeared foot-rot free were still carrying the infection.

Fig. 2.—A moist, hairless patch between the claws of this foot shows that the footrot organisms are still active in this area. The claws are also mis-shapen suggesting the presence of footrot lesions beneath the horn.

In other words, sufficient organisms remained alive in the feet of the sheep throughout the summer months, to provide a nucleus for the winter infection. As soon as conditions were satisfactory, these small points of infection which had barely maintained their viability during the dry period, multiplied rapidly and infected the pastures.

The feet which, throughout the dry period, had been shod with hard horn were now soft and water-soaked. Small wounds caused by grass-cuts, injuries from stones, doublegees, etc., offered easy entry to the footrot organisms and soon a massive infection was in full swing.

PREVENTING THE "CARRY-OVER"

How this "carry-over" of infection could be dealt with was demonstrated recently at the third of the "footrot schools" organised by the Chief Veterinary Officer (Mr. C. R. Toop) in order to familiarise Departmental veterinary officers and stock inspectors with this phase of disease control.

For the purpose of the demonstration, a flock was chosen which had carried a severe footrot infection during the winter, when large numbers of sheep were treated by hand-swabbing. Labour shortages and the absence of a footbath had made it impossible to follow up the preliminary treatment.

When this flock was inspected last winter, about nine sheep out of every ten had footrot—many in an acute form. Even though the initial treatment by footparing and hand-dressing left much to be desired, the treatment, plus the advent of dry weather, had reduced the incidence of infection to perhaps one sheep in seven which, of course, still left a substantial carry-over.

Although the flock had been run as one unit on the same paddocks, there was a striking variation in the condition of the individual animals according to the severity of the footrot infection.

Animals which had escaped infection or which had been cured early in the season were fat and carrying good growths of wool.

Where they had been more severely infected for longer periods, they showed a corresponding lack of condition, being at the forward or backward store stage according to the degree of infection.

Those sheep which had sustained a massive infection were poor and weak, badly woolled, with misshapen feet and sores on the brisket. These sores are caused by prolonged contact with the ground when the animal spends most of its time lying down because the pain in its feet prevents it from walking and grazing.

Fig. 3.—Both the inner claws on the hind feet of this sheep are malformed, with horny deposits on the inner surfaces. The outer claws on each foot are clean and healthy although somewhat overgrown. In the right-hand picture, one of the mis-shapen claws has been trimmed with the secateurs exposing a pocket of infection in which the footrot organisms are still active.

In most cases one could assess the severity of the footrot infection by a glance at the sheep—a striking object lesson on the losses which this disease can cause in the sheep and wool industry.

DETECTING THE "CARRIERS"

To eliminate the "carriers" which would be liable to reinfect the flock at a later date, it is necessary to put all sheep "over the board" and carry out careful examination of every foot, using the knife and foot-trimming secateurs where necessary.

In some cases, the skin between the toes will be seen as a moist, hairless area—on a healthy foot this skin carries a growth of hair and is dry and clean. The moist area carries footrot infection.

In others, a foot may appear healthy with normal skin condition but one, or sometimes two, of the claws will be mis-shapen. Trimming with the secateurs often reveals a pocket of infection overgrown with aparently sound horn. This "pocket" is moist and has the typical footrot odour.

Sometimes a claw would have an unsightly bulge at one side. This might be due to "separated wall" which had allowed soil and dirt to accumulate between

Fig. 4.—The foot on the left of the picture is clean and healthy and quite normal in appearance. The other foot has a mis-shapen claw with a moist infected patch extending into the coronet above the cleft of the foot. Later in the summer, the skin condition would probably clear up without attention but infection might still lurk in the malformed claw unless this was trimmed down and treated.

the horn and the sensitive portion of the foot—or it may conceal a pocket of footrot. In either case it needs to be opened up.

Another common result of footrot infection is an accumulation of horny material which is deposited on the inner face of the claws in the cleft of the foot. Often when this is snipped away, active footrot lesions are found beneath it.

Fig. 5.—Malformed feet resulting from footrot infection. Any such feet should be regarded with suspicion and trimmed severely to uncover pockets of infection which may have been hidden by the growth of horn.

TREATMENT

Dry weather offers a good opportunity to eradicate footrot from a flock. As the sheep are put over the board, the feet are trimmed and all the obviously sound animals are put through a footbath of 5 per cent. formalin solution or 10 per cent. bluestone solution. They should be held in the footbath for about 15 minutes before being turned out, preferably into a spelled paddock.

Infected animals and any doubtful cases, should have the feet thoroughly pared down to expose any pockets of infection, and should then be given the footbath treatment and placed in a quarantine paddock that is securely fenced to prevent them from mingling with the "clean" flock.

Where possible, it would be advisable to dispose of the obvious carriers and "suspects", either by using them as "killers" or selling them for immediate slaughter.

This is a short cut to eradication of the disease from the flock and has everything to recommend it.

Fig. 6.—Members of the "footrot school" trimming and examining the feet of sheep from a footrot-infected flock.

Alternatively, the footrot-infected animals could be treated by periodical foot-paring and footbath treatments, but no sheep should be transferred to the "clean" flock until they have passed a probationary period in a special paddock and been passed as healthy on two separate inspections with a month between them. Any long-standing or severe cases are better slaughtered, as they remain a potential source of infection.

The "clean" flock should be given periodical inspections and the foot-paring and footbath treatments repeated as frequently as possible to guard against animals which have carried concealed infection.

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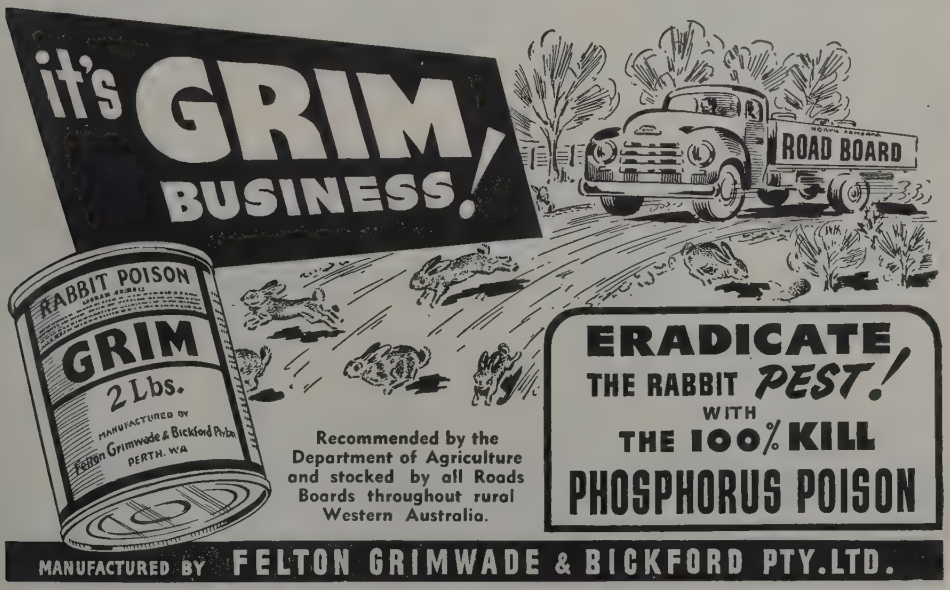
Arrangements have been made for the compilation of a comprehensive index to be incorporated in the December issue—a feature which will greatly enhance the value of the Journal as a work of reference.



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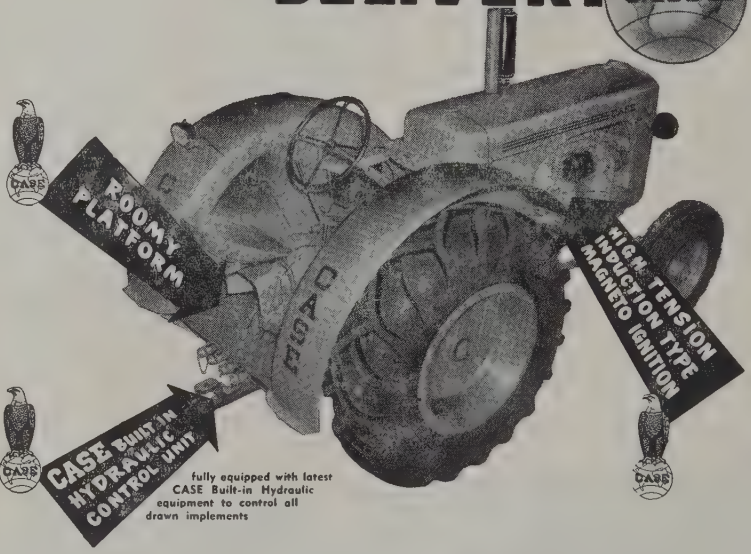
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INSECT Pests AND THEIR CONTROL

By C. F. H. JENKINS, M.A., Government Entomologist

THE CABBAGE MOTH

(*Plutella maculipennis* Curt.)

THE cabbage moth, sometimes known as the diamond-back cabbage moth because of its markings, is well known to all cabbage and cauliflower growers. It may also infest other members of the cabbage family, such as turnips, brussels sprouts, stocks, etc.

The moth is an insignificant creature, measuring a little over half an inch across the expanded wings, greyish brown in colour, with some lighter markings showing on the back when the wings are closed.

Fig. 1.—Cabbage moth, side view (enlarged).

The greenish yellow eggs just visible to the naked eye are laid singly on the leaves, and soon hatch into tiny caterpillars.

With cabbages, it is the outer leaves of the young plants which are first attacked, but as the heart commences to develop, the more tender leaves receive attention, and in the case of severe infestations the plants may be so badly riddled as to be rendered useless. When fully matured the caterpillars spin thin white silken cocoons, within which they pupate and remain attached to the under-surface of the leaf.

At first the young caterpillars burrow into the leaf and form tunnels in the plant tissue, but after a time they emerge from their burrows and commence feeding on the lower leaf surface. Often large patches may be eaten away, leaving only the thin transparent upper leaf surface intact. This film is, of course, easily broken and a ragged hole is left as a result of the injury.

The full-grown caterpillars measure about ½in. in length, are bright green in colour and show great activity if disturbed. When touched they will wriggle and squirm violently and often fall to the ground or let themselves drop from the leaf suspended by a silken thread.

Fig. 2.—Cabbage moth with wings extended to show patterning.

Fig. 3.—Leaf of cabbage showing damage caused by caterpillars of the cabbage moth, with larvae and cocoons on the leaf (reduced).

DDT dusts or 0.1% DDT sprays give satisfactory results. Where aphides as well as caterpillars are attacking vegetables, a combined dust containing DDT and BHC ("Gammexane" or Benzene-hexachloride) is often favoured.

If arsenate of lead is preferred for any reason by a grower a dust consisting of equal parts of arsenate of lead and slaked lime is recommended. When arsenate of lead sprays are used, the mixture should be applied at the rate of ½oz. of powdered arsenate of lead or 1oz. of paste to 1 gallon of water. The mixture must be kept thoroughly agitated while in use, as the arsenate of lead is not soluble and will gradually settle to the bottom. The addition of a proprietary spreader, or 1oz. of flour mixed to a paste, to every gallon of spray will increase its sticking properties.

LIFE CYCLE

The time required for this pest to develop from egg to adult varies considerably with the weather conditions. The eggs may take from a few days to over a week to hatch, while the caterpillars may take anything from ten days to a month to pupate. The pupal stage ranges from a little under a week to a fortnight or more. From this it will be seen that under favourable conditions a generation of the cabbage moth could develop about every month.

CONTROL

A careful watch should be kept for the first signs of cabbage moth injury so that early action can be taken against the pest. Seed-beds and young plants should receive routine treatments to prevent any infestation becoming firmly established. DDT dusts and sprays have now largely supplanted arsenate of lead as a control for many caterpillar pests and 2%

Fig. 4.—Dusting cabbages using a wheelbarrow type of engine-driven duster.

Treatments should be repeated about every ten days or a fortnight according to the severity of the infestation. But it cannot be too strongly emphasised that one treatment given to check an incipient outbreak is worth half a dozen given after the pest has gained a firm hold.

Cold, wet weather during the winter definitely retards the pest, but long dry periods during this season of the year should be a sign to the gardener to be on the watch.

WARNING

Dangerous insecticides such as DDT and arsenate of lead should not be applied to vegetables within six weeks of cutting. If thorough treatments are given in the early stages, it is often possible to so reduce the pest that the mature vegetables can be protected by other measures. Where later treatments are necessary, derris compounds should be used as these will not leave dangerous residues.

BIOLOGICAL CONTROL

Several species of wasps, some especially introduced for the purpose, are known to parasitise caterpillars of the cabbage moth and at times large numbers are killed by these natural enemies. At the present stage, however, their efficiency is not such that growers could safely neglect normal insecticidal treatments.

CULTURAL METHODS OF CONTROL

All old infested plants should be destroyed and as far as possible seedlings should not be planted close to areas previously laid down to closely related crops.

When cutting cabbages, etc., the whole plant should be pulled up so that the butt is not left to act as a harbour for pests.

The destruction of weeds of all kinds should be carried out as a routine practice, no matter what pests it is desired to control.

Fig. 5.—Dusting cabbages with a knapsack duster.

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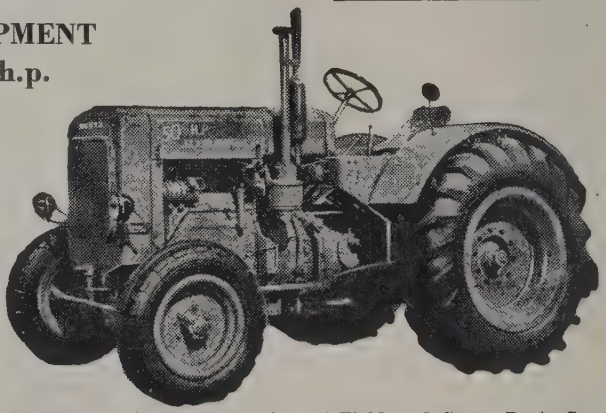

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PLANT DISEASES

CUCUMBER MOSAIC

By H. L. HARVEY, B.Sc. (Agric.), Senior Plant Pathologist.

MOSAIC is a common disease of early cucumbers in Western Australia, and has been observed in most vegetable-growing districts for a number of years. The disease is caused by a virus which is spread from plant to plant, mainly through the agency of aphides, and it follows as a rule that in seasons of heavy aphid infestations the incidence of mosaic is high and, conversely, when the aphides are scarce the disease is not so serious.

The disease does not appear to be soil-borne, and transmission with cucumber seed is considered to occur only rarely, if at all.

FIELD SURVEYS

In early cucumber plantings in the spring of 1951 mosaic was observed to cause considerable losses in two or three

Fig. 1.—Left: A cucumber leaf infected with mosaic. Right: A healthy leaf. —(After K.M.S.).

Fig. 2.—Above: A healthy cucumber. Below: A cucumber infected with mosaic. Note mottling and malformation.

commercial gardens in the metropolitan area and in the spring of 1952 and 1953, surveys showed it to be widespread, though seldom affecting more than five per cent. of the plants. However, the potential danger of the disease is indicated by the fact that in one garden, 35 per cent. of the plants were infected. In the summer (January) of 1953 and 1954, when maximum temperatures ranged between 80° F. and 100° F., no symptoms of mosaic could be detected in the later cucumber plantings. This may have been due to the virtual disappearance of aphid vectors, or to masking of symptoms by high temperatures, or to both.

SYMPTOMS

Mosaic-infected cucumber vines are very conspicuous in the field by comparison with healthy vines. They are stunted due to rosetting or shortening of the stems. The leaves are small and their pale colour contrasts with the darker green foliage of the normal plants.

On closer inspection, affected leaves show an obvious yellow and green mottle or mosaic pattern from which the disease derives its name (Fig. 1). If diseased plants produce fruits, they may be undersized and malformed with a mottling of the skin and the formation of warts or blisters (Fig. 2). Quite apart from the low yields, the quality is poor and it is unusual to market first-grade cucumbers from infected plants. When the disease is severe, plants may die prematurely.

HOSTS

Cucumber mosaic may infect many different plants, but in Western Australia it is only of serious commercial conse-

quence on cucumbers. Other hosts include the melon family of which rockmelons have been observed to suffer some slight damage. Tomatoes in some seasons of heavy aphid infestation have become infected, and the effect in this case is one of malformation of leaves which asume a "shoe-string" or "fernleaf" shape.

Hosts other than cucumber are important mainly as reservoirs or infection centres for the spread of the disease.

Hosts Recorded in W.A. (naturally or artificially infected):—Cucumber, vegetable marrow, rockmelon, tomato, New Zealand lupin, petunia, common thornapple *(Datura stramonium)*, and tobacco. The passion vine is a suspected host in this State.

Some Additional Hosts Recorded Elsewhere:—Pumpkin, squash nasturtium, cowpea, vinca, aster, calendula, zinnea, lobelia, capsicum, nightshade, lilies, maize, gladiolus, passion vine.

CONTROL

1. **Rogueing.** Remove and destroy each infected cucumber plant as soon as symptoms appear, especially during early stages of growth. Avoid handling healthy plants during this operation.

2. **Insect Control.** Aphides are the main agents responsible for the spread of mosaic from diseased to healthy plants and they should be kept under control by regular applications of suitable insecticides. Control of aphides is discussed fully in Leaflet No. 2015, which is obtainable free of charge on application to the Department of Agriculture, Perth.

3. **Weed Control.** Weeds should be kept under control in the vicinity of cucumber plantings because (a) they may harbour aphides and (b) they may be hosts of mosaic.

4. **Location of Beds.** New plantings should be made as far as possible away from old cucumber beds, other vegetable hosts and flower gardens in order to reduce the risk of spread of mosaic.

5. **Sanitation.** Destruction of old plantings is recommended as soon as picking is finished.

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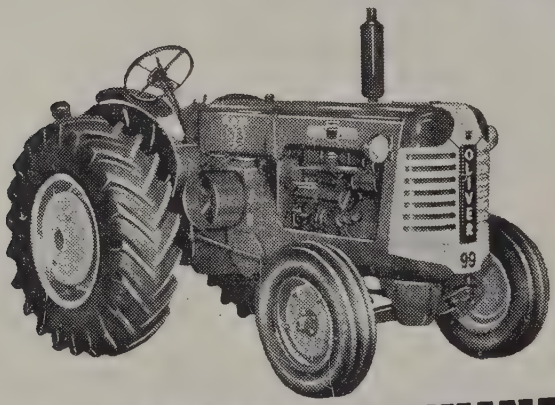

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SARCOPTIC MANGE OF PIGS

By C. R. TOOP, B.V.Sc., Chief Veterinary Surgeon.

THE losses to the pig industry which may result from sarcoptic mange do not appear to be fully appreciated. This disease is already firmly established in Western Australia and every precaution should be taken to ensure that it does not become more general.

Sarcoptic mange is a contagious skin disease caused by a parasitic mite which forms burrows in the skin, producing symptoms of intense irritation with unthriftiness and stunted growth in young pigs, and delayed fattening in older animals.

The occurrence of the disease on a property is always associated with the introduction of infected animals, and pig raisers should take the precaution of carrying out a careful inspection for the presence of infection when new purchases either of stores or breeding stock are made. Once introduced the infection usually spreads steadily through the herd and becomes a source of serious loss. The disease is fortunately amenable to control and may be completely eradicated by simple and relatively cheap methods of treatment.

CAUSE

The mange mite of the pig (*Sarcoptes scabiei*, var. suis) spends the whole of its life on the host animal obtaining its food requirements from the skin tissues and blood. The female mite is about 1/50th of an inch in length and the male somewhat smaller.

These parasites are white or yellowish in colour and while not visible to the naked eye, may readily be detected under a hand lens or the low power of the microscope. The body is rounded and the mature parasite has four pairs of short, thick legs. The female mites burrow into the skin, each making a separate gallery in which the eggs are laid. Each female lays 10 to 25 eggs which hatch out in three to 10 days giving rise to a new generation of mites which in turn form new burrows and commence laying when 10 to 12 days old. The complete life cycle occupies two to three weeks and under favourable conditions, the mites continue to multiply rapidly so that in the space of six weeks, the whole skin surface of the body may become involved.

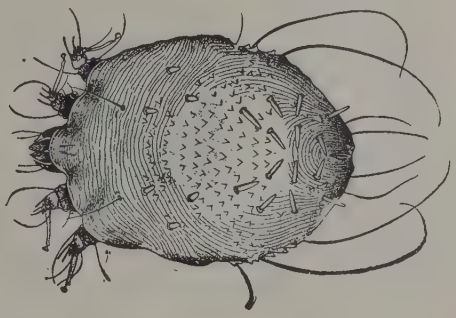

Fig. 1.—The mange mite of the pig, magnified 100 times.

MODE OF TRANSMISSION

Sarcoptic mange is spread from pig to pig by direct contact and when the disease makes its appearance in a piggery, there is invariably a history of new pigs having been introduced at some time or other from a source to which the infection can be traced. The spread of the disease is usually more rapid when pigs are housed in close contact with one another than when running in paddocks or large enclosures. Infection may also result from contact with infected premises.

Although the mange mite is unable to propagate apart from its host it is able to survive for a short period after removal from an affected animal. Under cool, moist conditions, the parasite may survive in bedding and litter for as long as four weeks, but when conditions are hot and dry it does not live for more than a few

days and these factors need to be considered when eradication measures are being applied.

SYMPTOMS

Pigs of all ages and breeds are susceptible but young pigs are most seriously affected, and this is especially the case if they are debilitated as the result of inadequate feeding or from the presence of other diseases. The predominant symptom is intense itching, resulting from injury and inflammation of ths skin, caused by the burrowing female mites. Affected pigs continually rub themselves against posts, feed troughs, and other objects, and scratch at the body with their hind feet.

Fig. 2.—A young pig showing advanced symptoms of sarcoptic mange. —(After Hutyra & Marek.)

The skin is scaly and studded with small nodules which form around the entrance to the burrows. From constant rubbing, parts of the body, particularly the sides, shoulders and thighs, become denuded of hair and as the result of mechanical injury to the skin, large scabs make their appearance while in advanced cases the skin becomes thickened and leathery and is thrown up into wrinkles or folds. The infection usually commences around the ears, eyes and nose and from there spreads along the neck, sides and back until the whole body becomes involved.

Because of the severe and constant irritation, young pigs cease to make normal growth becoming stunted and unthrifty, while in older animals in which fattening is delayed, the age of marketing is considerably increased. Death may occur in severe cases.

DIAGNOSIS

Symptoms of skin irritation may result from other causes, lice if present cause considerable irritation accompanied by symptoms of frequent rubbing and scratching. Pig lice, however, on account of their large size will be detected without difficulty. Moreover the itching caused by the mange mite is much more severe and if in addition there is evidence of thickening and wrinkling of the skin, this will usually serve to place the diagnosis beyond doubt. If it is desired to confirm the diagnosis, skin scrapings should be submitted for microscopic examination. These should be obtained by scraping an affected area of skin with a blunt knife until the blood just commences to show and the material so removed should be transferred to a small bottle and forwarded to the Deparment for examination.

TREATMENT

In the control and eradication of mange in pigs, excellent results may be obtained from the application of crude oil or used lubricating oil. Oils from which the lubricating constituents have been removed are unsuitable. Sump oil which is cheap and readily obtainable is very effective. The oil may be applied by dipping, spraying or hand dressing. Dipping, however, provides the only practical and really effective method of control when the treatment of large herds is involved. It presents no great difficulty and provided the dip is equipped with a strong, well-constructed entrance race and exit ramp, the pigs will run quite freely.

The dip which is re-produced in the accompanying photograph has been used with very satisfactory results. It is built of concrete, the walls being 4½in. in thickness. It is 21ft. long, 2ft. 6in. wide and 5ft. 6in. deep and is provided on either side with a closely boarded wall 2ft. 6in. high to prevent splashing. A dip of these dimensions will contain sufficient fluid to

completely immerse large boars and breeding sows and could, with advantage, be installed on all large piggeries. It will also serve for the control and eradication of lice.

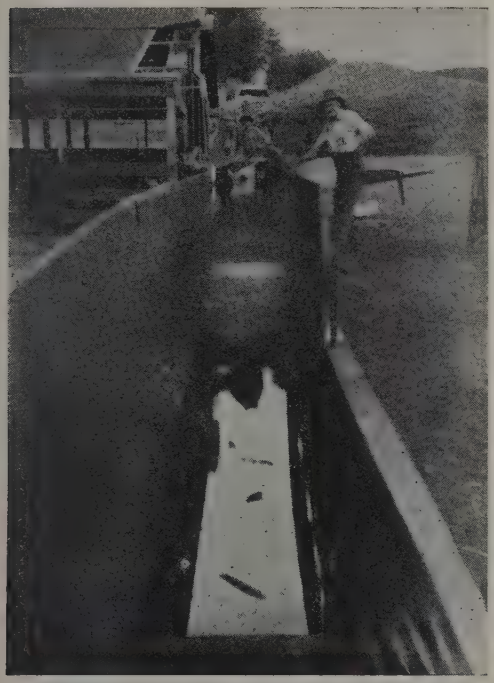

Fig. 3.—An oil dip as used for the control of sarcoptic mange and pig lice.

In preparing the dip for use, it should be filled to the required level with water following upon which sump oil or crude oil should be added until it forms a layer 6in. in depth floating on the surface of the water. As they swim through the dip the bodies of the pigs become completely coated with oil but in order to destroy mange mites which have become established around the ears, eyes and nose, the head of each animal should be ducked by means of a crutch or forked stick. Each pig removes a quantity of oil from the dip and in the treatment of mixed herds an allowance of 1½ pints per head should be made and the dip should be replenished from time to time as required. A draining pen should be provided for the collection of the surplus oil which drips from the animals.

After dipping with oil, care should be taken to prevent exposure to bright, hot sunshine. The pigs should be handled quietly and allowed to rest for 24 hours in well-shaded yards.

In order to completely eradicate the disease, dipping of the whole herd is necessary. If treatment is restricted only to those animals which are obviously affected this will result in pigs in the early stages of the disease escaping attention and they will continue to transmit infection to other animals with which they are in contact. Sows within two weeks of farrowing should not be dipped but they may be safely treated, together with their litters, when the young pigs are four weeks old. If treatment is undertaken early, it is possible to completely eradicate mange from a herd of pigs by a single dipping. When the disease is more advanced and there is evidence of thickening and wrinkling of the skin together with scab formation, two or more dippings repeated at intervals of 10 days will be necessary before this result can be achieved.

In the absence of a dip the oil may be applied by spraying. A stirrup pump fitted with a hose and a Bordeaux nozzle may be used for this purpose. Sump oil will pass freely through a nozzle of this type. This method of treatment, however, is much slower and more wasteful of material and since it is difficult to completely cover the body of the animal with oil it is less efficient than dipping.

Hand dressing is even less satisfactory and is only practicable when the treatment of a very small number of animals is involved. Equally good results may be obtained by dipping or spraying with a gammexane (benzene hexachloride) preparation containing not less than 0.1 per cent. Gamma B.H.C. Any of the gammexane sheep dips used at 10 times the strength recommended for the dipping of sheep, will provide a mixture of the required concentration. Care must be taken to ensure that all parts of the skin are thoroughly saturated and that the solution reaches the insides of the ears where mites may be concealed. Treatment should be repeated after an interval of 7-10 days.

After dipping, the pigs should be transferred to clean quarters but, should this not be possible, the quarters which they occupy should be cleansed by gathering

together and burning all bedding and litter and spraying the walls and floor with 5 per cent. Lysol solution (8 oz. of Lysol to 1 gallon of water). This will destroy mange mites remaining on the premises which under favourable conditions would be capable of surviving for several weeks and of reinfecting the treated animals.

When the disease has been eradicated the precaution should be taken of dipping all newly-purchased animals before their introduction into the piggery is permitted.

Reprinted and revised from *Journal of Department of Agriculture of Western Australia,* Vol. XXII (Second Series) No. 1, March, 1945.

EVEN THE JUNK-HEAP IS ORGANISED

At Liveringa Station, West Kimberley, the manager, Mr. K. C. Rose, is a firm believer in orderliness. Even the station scrap-heap is arranged so that odd scraps of metal and miscellaneous materials are readily available if required

PREPARATION OF FRUIT FOR MARKETING

Part 2—Handling, Grading and Sizing

By J. S. BLOOMFIELD, Packing Instructor.

THE orchardist's careful attention to such operations as pruning, spraying and thinning in his effort to grow good quality fruit may be nullified to a large extent by carelessness at harvesting or during the subsequent period of handling before the fruit reaches the consumer. The grower cannot afford to become careless at any stage for every injury to the skin surface or underlying tissues of the fruit will ultimately show up as a bruise, puncture or other blemish. Many of these injuries may not be noticeable at the time of picking but will be only too obvious when the fruit is offered for sale.

There are several stages in the picking operation where damage can occur and the following are probably the most important faults.

1. Careless dropping of the fruit into the picking bag.
2. Bumping the picking bag against the ladder or against the knees when moving about.
3. Tipping the fruit, instead of carefully lowering it into the picking box.
4. Filling the fruit above the level of the box, causing damage when the boxes are stacked.

Picking is essentially seasonal work and usually needs to be completed in a limited time. Some of the above points may therefore be overlooked, particularly where inexperienced labour must be used.

PICKING BOXES

Although the initial cost of providing special picking boxes may seem high, the benefits will more than compensate for the outlay.

The picking box should be sufficiently wide to allow any type of picking bag to be lowered to the bottom of the box before releasing the fruit. It should be constructed of pine to minimise the weight; the boards should be thicker than the ordinary dump case to give greater stability, and all boards should be butted to leave no gaps.

The old time "kero" box which has been used extensively in the past, provides a very suitable pattern. Kero cases with normal care and attention have been used as long as 30 years, so that the apparent high initial cost can be spread over a considerable period. Should the standard apple box come into general use then separate picking boxes would be essential.

With proper picking boxes stacking is much more satisfactory because the sides are stronger and flush with the top of the box. They will also stand cross stacking better and in every way are a much more useful container. A well-filled "kero" case of apples will pack out a bushel case.

Dump cases have been used extensively since the war for picking apples but they are not ideal for this purpose. Considerable damage occurs to new cases both in handling and by exposure to the weather, while fruit handled in this way is more liable to injury because of the wide gaps between the boards, especially with sliced boards which are inclined to buckle. Should it be necessary to use dump cases for apples and pears then strawboards can be used to advantage for lining the bottom and sides.

Special picking boxes are also very useful for citrus fruits, although for this purpose a box of more open construction may be preferable to enable quicker drying of the fruit during the winter.

Fig. 9.—Damage to fruit is often caused by careless tipping into the picking boxes. Such damage can be minimised by lowering the picking bag to the bottom of the box before releasing it.

A cleated lug box similar in size to the "kero" case but opened on the side is a very satisfactory container for handling pears.

Stone fruits should be handled as little as possible. Picking bags cannot be used and it is usual to pick directly into cut down four-gallon tins fitted with handles.

DELIVERY TO THE PACKING SHED

Much of the fruit in this State is harvested during the hottest part of the year and therefore requires careful protection to prevent deterioration from undue exposure to the hot, dry atmosphere. Picked fruit, awaiting transport from the orchard, should be stacked in the shade of the tree and moved to the packing shed as soon as possible. Where practicable, fruit is best picked first thing in the morning while the atmosphere is still cool; but when it is removed from the trees in late afternoon it is preferable to leave it in the orchard overnight to benefit from the cool night air in preference to stacking it in a hot shed. Stone fruit requires much more careful handling than other fruits owing to the rapid rate of ripening. Pears and stone fruit which are not required for immediate sale should be placed in cool store as soon as possible after picking. This will assist in maintaining the condition of the fruit and in obtaining the maximum storage life.

Most fruit, in these days, is transported from the orchard to the central packing shed by road and, provided the trucks are well laden, apples and pears can be transported quite well over comparatively rough roads.

With few exceptions, fruit should be packed as soon as possible after receipt at the packing shed. Exceptions where a short shed storage period is an advantage, are late harvested Granny Smiths and winter-harvested citrus fruits. Granny Smiths picked late in May are very susceptible to bruising even under normal handling conditions, and should be held for a few days in the shed prior to packing to minimise this damage. Citrus fruits, particularly those harvested in the winter months, benefit from a few days' storage before packing.

SORTING

Every line of fruit passing through the packing shed will contain a proportion which does not conform to the grade being packed and must be removed before going to the packers. Even in small grower sheds where the sorting and packing

is done by the same persons, the fruit should be graded before going to the bins as this will simplify packing operations. The packers have to contend with the size of the fruit, the various packs, and variable-sized cases and should not be called upon to grade the fruit as well.

The person sorting the fruit must be responsible for the grade and should be in a position to check the results of the work by examining the fruit in the bins at intervals. This does not mean that the packer should not look for and remove obvious rejects, but the less attention that is required in this respect the more effectively will the packing be carried out.

Fig. 10.—Skin injuries to fruit can result from careless tipping, overfilling the hopper or failing to remove twigs and other foreign matter.

Grades are standards of quality laid down by regulation to maintain uniformity in the marketing of the fruit both locally and overseas. Grading is therefore the sorting of the fruit into various quality groups or grades. Thus for apples and pears there are "fancy" and "good" grades and for citrus "standard" and "plain" grades. In this State it is usual to market fruit predominantly under one grade. For instance, apples and pears are packed chiefly as a "fancy" grade. Citrus fruits on the other hand are marketed mainly as "standard" grade.

Grading is a most important operation, as the efficiency with which the work is carried out will determine the uniformity of quality of the final pack. Too often, lines are rejected for export or de-graded, because insufficient attention has been paid to the sorting and the large proportion of good fruit is spoilt by the small proportion which should not have reached the packing bin.

The component parts of the fruit-grader comprise the hopper, elevator, sorting table, sizing rollers and bins. The fruit comes to the sorters from the hopper which is usually fitted with a device for feeding the fruit on to the elevator. Considerable damage can occur to fruit if the hopper is not kept free from twigs and other debris; if the hopper is overfilled, or if the picking-box, during the process of emptying, is allowed to rest on the fruit. The operation of tipping apples into the hopper is shown in Fig. 10.

Sorting facilities will vary with the amount of fruit to be handled. The average grower packing his own fruit will sort it as it passes up the elevator from the hopper, and place rejects in boxes nearby. In larger sheds sorting tables are used. This makes the job much less tiring, allows more than one sorter to operate and thus enables a larger volume of fruit to be handled. In front of the sorting table, conveniently-placed conveyor belts enable the sorters to dispose of rejects without loss of time. In the case of apples, two belts are ideal, one for good grade or local market fruit, the other for rejects. Similar conveyors should also run above the packing bins within easy reach of the packers. Apart from ease of handling on conveyor belts, less damage is done this way than by dropping the fruit into boxes. Spring-loaded case holders attached to the end of the conveyor also help to keep bruising to a minimum. A satisfactory set-up is shown in Fig. 11.

On some machines a common sorting table feeds two separate sizers placed back to back. In this State where the percentage of rejects is usually small this

Fig. 11.—Fruit from the hopper passes up the elevators to the sorting table. Good grade or local market fruit is placed on the lower belt in front of the sorters and "rejects" on the upper belt. Spring loaded boxes at the end of the conveyor reduce bruising.

arrangement is rarely warranted and individual sorting facilities are normally provided for each machine. Where small lines of fruit have to be dealt with or it is desired to pack two different varieties, this arrangement is a decided advantage. As in the previous set-up the machines stand back to back but each is a separate entity with an independent drive.

SIZING

From the sorting table the fruit moves by endless conveyor to the sizing component of the machine. The actual sizing is affected by the fruit being carried along an endless belt past a series of rollers set at varying heights to allow fruits of different sizes to pass into allotted bins. The rather loose use of the term grader has led to the incorrect use of the word grade when actually size is meant. The component which segregates the fruit into the various sizes is really a sizer and not a grader. Furthermore, sizes are actually size ranges, varying by $\frac{1}{8}$ inch. For instance, a $2\frac{1}{2}$ inch fruit is one which is $2\frac{1}{2}$ inches or greater at its maximum diameter but is less than $2\frac{5}{8}$ inch. In other words the fruit will pass through a $2\frac{5}{8}$ inch sizing gauge but not through a $2\frac{1}{2}$ inch ring.

ADJUSTING THE SIZER

It is most important to be able to set up a sizing machine and know how to adjust it so as to make one pack from each bin. Packing charts are based on correct sizing, and success in following these charts will depend on proper machine adjustment. The first column in any chart always gives the size of the fruit.

For setting up the orthodox machine fitted with a series of individual rollers, a set of vertical gauges increasing by $\frac{1}{8}$ inch increments is used. Commencing at the hopper end of the machine each roller is adjusted in turn. This is done by slackening off the roller, placing the correct gauge between the belt and the roller at the hopper end and tightening it down until it just touches. The far end of the roller is then set in an identical manner and then raised approximately 1/16 of an inch. This operation is illustrated in Fig. 12.

This 1/16 inch variation along the length of each roller allows a slight variation in the size of fruits entering each bin which is necessary to produce the desired packs. This adjustment will, however, vary slightly according to varieties and more particularly with size. Small fruit is generally more regular in size than larger fruit and therefore it may be necessary to raise the roller more than 1/16 inch for small sizes and slightly less than 1/16 inch for larger sizes. Should the finished packed case come a little low, a few still larger fruits will be required. This is achieved by slightly raising the end of the roller away from the hopper. On no account should the setting of the hopper end of the roller be altered, all adjustments should be made at the opposite end.

An alternative adjustment, where the pack is coming too low would be to slightly raise the roller in the previous bin thus removing some of the smaller fruit which would otherwise go into the bin the case is being packed from.

Should the pack be too high the reverse procedure would apply. In other words, the roller on the bin in question should be slightly lowered. The same variety of fruit from different parts of the orchard will often vary in shape but a slight alteration to the sizing rollers will rectify any adverse effect this may have and maintain a standard pack.

When making gross adjustments to the sizing machine, for instance when changing from small fruit such as mandarins to large fruit like grapefruit, it is necessary to move the whole beam which supports the sizing rollers. This is easily and quickly done. Most commercial machines have $\frac{3}{8}$ inch adjusting screws which are threaded with 16 threads to the inch. This simplifies the adjustment as eight complete turns of the adjusting nut will equal approximately a $\frac{1}{2}$ inch movement of the beam.

The beam should be distinctly off-set so that it runs across the belt along the length of the machine. This means that the fruit will be running towards the top edge of the belt at the feed end of the sizer but nearer the bottom edge of the belt at the far end. This has the effect of lessening the pressure of the fruit against the rollers, thus minimising mechanical damage.

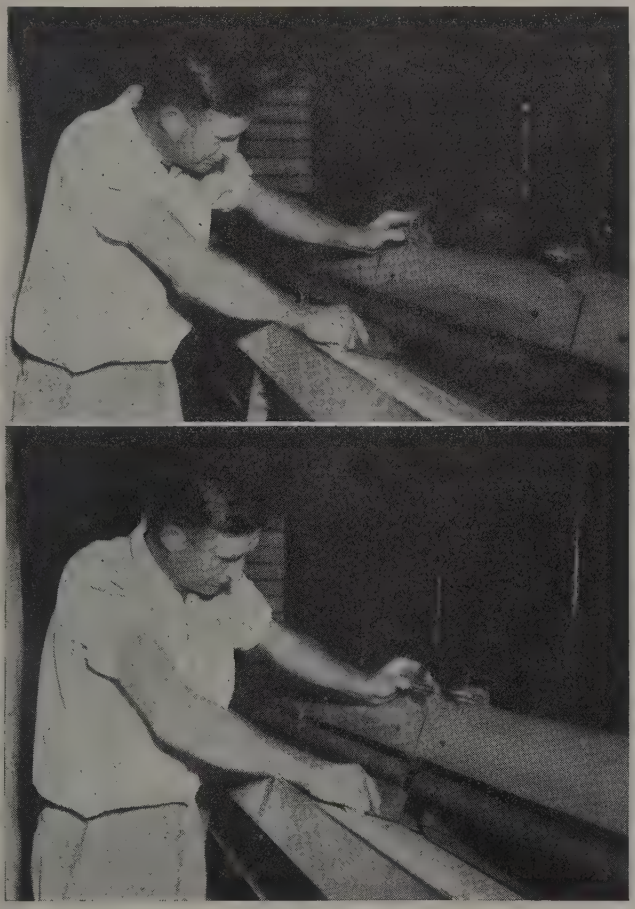

Fig. 12.—Adjusting the sizing rollers. In the top picture the end of the roller nearest the hopper is being set to a gauge. (Below) The opposite end is similarly adjusted and then raised 1/16th of an inch.

Belt speed is important to uniform sizing. Often the speed of the belt is too high and this causes mixed sizing. Uneven belt speed which may occur with engine-driven machines will also produce a similar effect. Uneven running may be detected by placing the hand firmly upon the belt while the machine is in operation and walking along behind it.

With a positive driven machine, that is where the rollers cannot be left undriven, the following speeds are an advantage. For round fruit such as oranges a normal speed for the belt and rollers is best. Long-type fruit such as lemons require a slow belt speed but a fast roller speed. Flat fruit, such as grapefruit, will size better with a fast belt and slow rollers. On machines fitted with friction roller drive, however, driving the rollers is optional. The free roller is better in most instances except for some long-type fruit where a driven roller can be used to an advantage.

BINS

There are two types of bins in general use. In the past, canvas spring type bins were used exclusively, but in more

recent years the rotary bin has become very popular. While the rotary bins are considerably more expensive and therefore are limited to larger sheds they have many advantages in handling the fruit and should be installed wherever the quantity of fruit warrants.

As the name suggests, the rotary bin when in operation gradually rotates and receives fruit as it comes off the sizer. The fruit in the bin is maintained at a uniform level, no pulling down is necessary while the packer has a better view of the fruit being handled. Furthermore, these bins have a considerably greater capacity than the ordinary canvas bins and bruising resulting from fruit running into them is practically eliminated. With extra care pears, other than Comice, have been successfully handled with this type of equipment.

(To be continued.)

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PEANUT GROWING ON THE LEVEE SOILS OF THE GASCOYNE RIVER

By J. A. LAWSON, B.Sc. (Agric.), Agricultural Adviser.

RECORDS show that in 1920 a number of blocks of land along the Gascoyne River were thrown open for the purpose of commercial peanut production, the main purpose being to establish ex-service settlers on this land. Seed was planted on these blocks but failed to germinate; rumour has it that the nuts had been previously roasted! Ten years later, in 1930, Mr. J. Buzolic, an early settler in the area who had achieved success in growing tomatoes and beans, planted a crop of peanuts from which he claimed reasonably good returns. Thirty-six cornsacks filled with peanuts were shipped to Perth in what is believed to be the first West Australian commercial venture into peanut growing. The prices received for the nuts at that time were such, however, that the crop could not compete favourably with others under irrigation conditions.

In September, 1952, the first comprehensive peanut trial was conducted at the Gascoyne Research Station, its purpose being to investigate the methods of irrigation and the phasic development of the crop under Carnarvon conditions.

Three methods of irrigation were tested, these being as follows:—

1. Rough bays were formed and the soil completely flooded. When dry enough to be workable the nuts were planted in rows, a small ridge being formed over each row so as to leave wide shallow furrows between the rows. As the plants attained greater size "hilling up" was carried out, giving larger ridges and deeper furrows.

2. Shallow furrows were formed 30 inches apart. This left a wide low ridge in the centre of which the nuts were planted. Hilling up was done as with Method 1, deepening the furrows. The first watering was given **after** planting.

3. Deep furrows were ploughed and prepared as for bean planting. The nuts were planted just above the water-line on each side of the furrows. Hilling up is not possible under this system.

Eight plantings were made, one each fortnight, so that the phasic development under changing climatic conditions could be studied.

The trial was carried out under difficult conditions, since the soil was heavy and structureless, the area having been bare and windswept many years.

In the irrigation trial, Method 1 gave the best results, since the gradual forming of a ridge gives better lateral pene-

Fig. 1.—Mr. Smeed standing beside one of the 68 stooks of nuts harvested from just under two acres.

Fig. 2.—Two average plants of peanuts selected at random.

tration of the water and leaves the soil in a friable condition more suitable for "pegging".

Method 2 was unsuccessful due to lack of lateral penetration, characteristic of most Gascoyne soils. Germination and pegging were poor.

Method 3 gave a good germination, but poor pegging. The nuts were also very difficult to harvest.

The phasic development trial indicated that October and November were the best planting months. Earlier plantings took too long to come to maturity, while later plantings flowered and pegged too early.

COMMERCIAL PLANTINGS

In December of 1952, several commercial plantings were made also, and much valuable information of a practical nature was gathered from these. The most successful grower was Mr. H. Smeed, who, after a number of setbacks, obtained 80 cornsacks of nuts in the shell from just under two acres. The crop was sown mechanically, but unfortunately the planting machine left gaps in the crop, so that, even though germination was good, the stand was uneven. Despite this, the crop developed very well, although, had hilling-up been possible when pegging was taking place, even more nuts would have formed. After stooking, a week of heavy rains was experienced, and a mould formed on the leaves and discoloured the nuts. This, too, caused considerable loss. The remaining nuts, although having discoloured shells, contained excellent kernels. The only pests of any importance were crows and foxes, which dug up the seed just after planting in some areas. In all plantings, the variety Virginia Bunch was used.

GROWTH HABITS

The peanut (Arachis hypogaea) is a legume, and is therefore capable of forming a "symbiotic" relationship with certain species of bacteria which take up atmospheric nitrogen for use in their own body processes. These bacteria, attached to the roots of the plant, then "exchange" nitrogen products for carbohydrates formed by the plant so that each member benefits. When such bacteria are active, nodules form on the roots of the host, and these, when broken, show a pink colour internally. Under certain conditions excess nitrogen products are liberated into the soil. The peanut plant itself is of a

Fig. 3.—The size of this plant may be estimated by the matchbox in the centre.

semi-prostrate habit, and is composed of a large number of tillers which, when fully grown, may cover a circle of three feet diameter. At each leaf axil the flowers appear, yellow and pea-shaped. When each flower dies back, a "peg" or haulon forms at its point of attachment, from which position it grows rapidly towards the ground, which it must be able to penetrate easily. At a depth of 1in. to 2 in., the hard top of the haulon enlarges and forms the nut. This habit is very similar to that found in subterranean clover.

Although only an annual, the plant is quite deep-rooted, and, once established, can withstand quite dry conditions. It is a summer grower, and under good conditions requires only five months from planting to harvesting.

Fig. 4.—A home-made cutter-bar attached to the hydraulic lift system of an Allis Chalmers tractor.

PEANUT GROWING UNDER CARNARVON CONDITIONS

1. **Selection of Soil**—A light, sandy soil is essential for best yields, since this allows easier emergence, pegging, and simpler hilling up during growth. Heavy clay soils should be avoided.

2. **Levelling**—Since the crop is grown under a system of furrow irrigation, the land must be very well levelled before planting. Rough preparation can lead to uneven watering, which greatly diminishes yields in any irrigated crop.

3. **Sowing and Ridging**—The best technique experienced to date, is that described in "Method 1" of the Gascoyne Research Station experiment. This requires three or four "hillings" during the season, which can be done with implements behind a tractor. When watering, the ridges should never be covered.

4. **Seed Treatment**—Certain moulds, such as those of the Penicillin species, will often attack machine-shelled seed, lowering the germination percentage. A light dusting with fungicides such as Tetroc or Ceresan will help prevent this. The latter will also kill the "Crown Rot" organism, if present. A bacterial culture, suitable for the inoculation of peanuts, may be obtained from the Department of Agriculture at a small fee. This, when applied according to the directions attached, will assure the establishment of the symbiotic relationship previously described, thus decreasing the likelihood of any nitrogen deficiency arising. The culture should be applied before the fungicide.

5. **Spacing and Seeding Rate**—The minimum distance between rows should be 30 inches; any wider spacing should be governed by the "track" of the implement used. A spacing of 9in. to 12in. between plants, though this may seem crowding, still allows complete pegging, since the bulk of useable nuts are found within the inner 12in. of the plant. A depth of 2in. is ample for sowing. For a width of 36in. between rows and a plant spacing of from 10in. - 15in., 30lb. seed per acre is recommended for the Virginia Bunch variety.

6. **Fertilisers**—Under Carnarvon conditions, if the bacterial culture is used on the seed, 1½ to 2 bags of blood and bone to the acre, applied at (or just prior to) planting time, should be ample.

7. **Water Requirements**—Frequency of watering will depend on the rate at which the soil dries out. In lighter soils, for plantings made in October-November, twice weekly waterings should be made for the first fortnight after emergence. The rate may then be cut down from once per week to once every ten days as the plant develops its tap root. When the kernels in the bulk of the nuts are fully formed, no further watering is necessary.

8. **Weed Control**—It is advisable, after levelling the area, to pre-irrigate it, and allow weeds to germinate. These should be turned in just prior to planting. If hilling is done at regular intervals, this too will aid in control.

9. **"Hilling up"**—The throwing up of soil from the furrows, to increase the size of the ridge will not only aid the plant in "pegging", but makes irrigation more simple. The final hilling should be carried out when the last flowers are forming, and should bring the width of the ridge to at least 15in.

10. **Harvesting** — The ridges finally formed make the first step in harvesting easier to carry out mechanically. A "cutter-bar" attached to the tool-bar of a tractor is sunk to a depth of 2½in. to 3in. This cuts the tap root and loosens the soil around the nuts. The plants are then turned over and allowed to dry out for several days (depending on weather conditions). Stooking is then carried out, small stacks four feet in diameter and four feet high being formed, the nuts turned towards the centre so that they may be allowed to "sweat". After two or three weeks of curing in the stooks, the plants are fed into a thrasher, which, operating on a principle similar to that of the wheat harvester, removes the nuts and discards the plants. In some areas, the tops are used as a stockfood after curing.

MECHANICAL AIDS

Except for stooking, it is possible to carry out the entire programme mechanically (i.e., by tractor and implements). The first ridges, formed at planting, may be thrown up by delvers attached to a planting machine. Hilling up requires a double-mouldboard or double-disc type delver, set deeper with each successive operation. Types of cutter-bar have now been developed to turn the plant over after cutting and loosening; and in some areas, even the stooking has given way to windrowing (done mechanically by side delivery rake). Threshing and bagging is also done by machine. By these means a substantial acreage can be handled, even under irrigation.

A good demand still exists for peanuts, and I believe that, under good conditions, yields of up to two tons an acre can be obtained on the Gascoyne.

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THE BABCOCK TEST FOR THE ESTIMATION OF BUTTERFAT IN MILK AND CREAM

By A. H. HOBBS, H.D.D., Dairy Produce Inspector.

FROM time to time inquiries are received from dairy farmers, and others, for details of the technique of the Babcock Test. An endeavour is made in the following article to describe in simple form the various steps in the manipulation of the test while, at the same time, drawing the attention of the beginner to the difficulties which may be encountered, and the necessary precautions to be observed, in order to obtain accurate and satisfactory results.

The Babcock Test was invented by Dr. Babcock, an American scientist, in 1890. It was originally designed for the estimation of the butterfat content of milk, but has since been modified and can be used for milk, cream, skim milk, buttermilk, etc. For practical factory and farm fat determinations, it is now used almost exclusively in the United States of America and Australasia.

It is the test generally used as a basis for payment for milk and cream and, in addition, enables producers to detect unprofitable cows, thus furnishing a valuable guide to herd improvement. It has also aided in the detection of fraud caused by the watering or skimming of milk.

Dr. Babcock based his test on the fact that strong sulphuric acid will break down the "solids not fat" of milk and thus enable the fat to separate out. To effect a speedy and complete separation of the fat the flasks holding the mixture of milk and acid are placed in a centrifugal machine, or so-called "tester," and whirled at high speed. Hot water is then added to bring the liquid fat into the graduated neck of the test flasks and, after repeated whirling, the length of fat column is measured, showing the percentage of fat contained in the sample tested.

DIRECTIONS FOR TESTING MILK

Apparatus required:—

Sample bottles.
17.6 c.c. pipette for measuring milk.
17.5 c.c. acid measure.
Sulphuric acid (specific gravity 1.82-1.83).
Milk test flasks (graduated 0-10).
Centrifuge (or tester).
Dividers.
Dairy thermometer.
Water bath.

Sampling.

The milk to be tested is first mixed by pouring from one vessel to another two or three times so that the butterfat will be evenly distributed throughout the bulk. The sample is then dipped out immediately and placed in a sample bottle.

Before measuring out the quantity to be tested, the milk in the sample bottle is further mixed by shaking the bottle vigorously. The shaking should not be so violent as to cause undue foaming. The reason for sampling immediately after mixing is that the butterfat is the lightest constituent of the milk and it will commence to rise to the surface within a few minutes if the milk is allowed to stand. Hence the sample taken would not be representative of the bulk.

The measuring pipette, which has a capacity of 17.6 cubic centimetres, is filled with milk by sucking the milk into it until this rises a little above the 17.6 c.c. mark; the forefinger is then quickly placed over the top end of the pipette before the milk runs down. By slightly releasing the pressure of the finger, the milk is now allowed to run down until it reaches the mark. The finger should be moist but not wet, so that the milk may be readily checked by gentle

pressure. The point of the pipette is now placed in the neck of the Babcock test flask, and the milk is allowed to flow slowly down the inside of the neck, care being taken that none is lost in the transfer. The last of the milk in the pipette is gently blown into the test flask.

Actually the amount of milk delivered by the pipette is 17.5 cubic centimetres, the difference, .1 c.c., being an allowance made for the small quantity which adheres to the walls.

The temperature of the milk at the time of sampling should be 65-70°F.

The accuracy of the test depends on the fact that the sample taken weighs 18 grams, and 17.5 c.c. of milk at its average specific gravity of 1.032 will be found to weigh this amount.

Adding the Acid.

17.5 c.c. of sulphuric acid, the temperature of which should be 65-70°F., is measured by means of the acid measure. This amount of acid is carefully poured into the test bottle containing the milk. In performing this operation, the test bottle is conveniently held at an angle, so that the acid will run down the wall of the bottle, and not run in a small stream into the centre of the milk. The bottle is slowly rotated during the adding of the acid, thus clearing the neck of adhering milk.

If the acid is poured into the middle of the milk, charring of the fat may occur, and there is also the danger of completely filling the neck with acid, in which case the expansion of air in the bottle may force the acid out on to the operator's hands.

The milk and acid in the test flask should be in two distinct layers. A black band of partially mixed liquid may appear between the layers, but this should be only slight. Such a dark layer often results in an indistinct fat column in the final reading. The appearance of black flocculant matter in or below the fat column renders a correct measurement difficult, if not impossible.

After adding, the acid is carefully mixed with the milk by holding the test bottle by the neck at an angle and giving it a rotary motion. In doing this, care should be taken that the liquid is not shaken into the neck, and when once the mixing has begun, it should be continued until completed. The mixture becomes hot by the action of the acid on the water in the milk and turns a dark chocolate colour. Its temperature will now be about 180°F. Violent mixing may cause charring of the fat, whilst insufficient mixing may produce curd in the fat column.

Note.—Sulphuric acid has a great affinity for water and will weaken, through the absorption of moisture from the atmosphere, if not kept in air-tight containers. It is very corrosive, hence stoppers for bottles should be of glass, earthenware, or rubber. It should be handled with care and, if spilt on the skin, should be washed off immediately with plenty of cold water. If spilt on the clothes, they should be washed as above and then treated with dilute ammonia solution.

Whirling the Tests.

The test flasks containing the mixture of acid and milk are placed in the centrifuge immediately mixing is completed, care being taken that they are placed in such a position that the machine is balanced correctly so that it will run without vibration.

Oil the machine before starting and increase the speed gradually. The correct speed is usually indicated on the crank of hand operated machines but, if not, it may be calculated from the diameter of the disc which carries the cups. The diameter is measured from the bottom of one cup, through the centre of the disc to the bottom of the opposite cup with both cups held in a horizontal position. The following speeds for discs of various size create the correct centrifugal force of 30 lb. per square inch inside the test flasks:—

Diameter of Disc.	Revs. per minute.
10 in.	1074
12 in.	980
14 in.	909
16 in.	848
18 in.	800
20 in.	759
22 in.	724
24 in.	693

To find the speed of the handle, give the handle one full turn slowly, and note the number of revolutions of the disc. This figure is then divided into the revolutions

desired, according to the size of the disc, and the answer will represent the number of turns per minute of the handle.

Correct speed is important, as low speeds give low readings. Slightly excessive speed is not harmful, but increases the pressure in the bottles and may cause breakages.

It is not absolutely necessary to whirl the test bottles in the centrifuge as soon as the milk and acid are mixed, but this method is much to be preferred. They may, however, be left for any reasonable time up to 24 hours without the test being spoiled; but if left until the mixture becomes cold, the bottles must be placed in hot water (about 160°F.) for fifteen minutes before whirling.

The first whirling of the test bottles is carried out for five minutes. This will bring all the fat to the surface of the liquid.

Adding the Water.

Hot water (temperature 160-180°F.) is now added by means of a pipette, or some special device, to fill the bottle to the base of the neck. The bottles are whirled again at full speed for two minutes and hot water as above is added a second time until the lower part of the fat column comes within the scale on the neck of the bottle, preferably about the 1 or 2% mark, so as to allow for the sinking of the fat column due to the gradual cooling of the contents of the bottle. This second filling of water should be allowed to fall directly on to the fat, to assist in the removal of any undissolved matter.

The bottles are now whirled a third time for one minute. This completes the test.

The above whirling times should be taken from the time the machine reaches the correct speed.

Measuring the Fat.

The correct temperature for reading the fat column is 140°F. This is important for the reason that temperatures 10-15° lower than this give low readings owing to contraction of the fat, and vice versa; also this temperature ensures that the fat column will have a sharply defined upper and lower meniscus. If several tests have been done in a hand operated machine, they should be placed in the water bath at 140°F. with the water depth equal to the height of the fat column and allowed to remain there for three minutes before commencing to read.

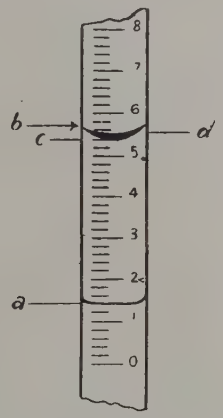


Fig. 1.—Correct method of reading the milk test. Read from a to b.

The water between the fat column and the mixture in the test bottle should be clear. If milky, this indicates that too little, too weak, or too cold acid has been used, and the solids not fat are not thoroughly dissolved. If black flocculant substances are present, the indication is that too much, too strong, or too hot acid has been used, or that mixing has been too violent.

The fat column is measured from the bottom of the column to the extreme top of the meniscus as illustrated in Fig. 1. This operation is simplified by the use of the dividers, by placing one point on the bottom of the column and the other on the top of the meniscus; then the dividers are moved, without altering the distance between the points, so that the bottom point rests on the 0 mark on the scale, and the upper point gives the reading in per cent. of fat. The space between each two large divisions on the scale equals 1%, and that between each two of the smaller divisions equals two-tenths or .2%. If the fat column illustrated in Fig. 1 is examined, it will be found that the bottom of the column is on the second small graduation above the 1, and the top of the meniscus is mid-way between the third and fourth small graduations above the 5. Therefore, the per cent. of fat in this instance is 5.7 minus 1.4 = 4.3%.

The reason for reading to the top of the meniscus is that it has been found by making a comparison between a large number of tests and the gravimetric analysis of the same samples, that an alowance has to be made for a small number of minute fat globules which, owing to their size, are not extracted from the mixture during whirling.

The relation between the amount of milk taken and the capacity of the graduated portion of the neck of the milk flask is as under:—

The amount of milk taken is 18 grams (17.5 c.c.). The neck of the flask is graduated 0 to 10, and the capacity of this graduated portion is 2 c.c. Since the specific gravity of butterfat at 140°F. is .9, the weight of 2 c.c. of butterfat is 2 x .9 = 1.8 grams, and 1.8 grams is one-tenth or 10% of 18 grams. Therefore, the graduated portion of the neck, when full of butterfat, at 140°F., would represent 10% of the sample taken, and the small divisions 1% and .2%, respectively.

The quantity of butterfat contained in a definite amount of milk is calculated by means of the following formula:—

$$\frac{\text{Weight of milk in lb. x Test}}{100} = \text{lb. of fat.}$$

Hence, if a cow produces in 24 hours, 36 lb. of milk with an average test of 4.3%, the butterfat contained in this milk will be—

$$\frac{36 \times 4.3}{100} = 1.548 \text{ lb. fat.}$$

COMPOSITE SAMPLING OF MILK

Where large numbers of different lots of milk are recorded daily, e.g., the milk supply to cheese factories, or in testing herds for production, a great saving in time, labour and material is obtained by the use of composite samples.

A composite sample is a mixture of samples of various deliveries of milk from the same source, taken over a period of time, usually not more than seven days.

To ensure that a composite sample is a true representation of the milk to which it refers, it is essential that each small sample should bear a definite relation to the quantity of milk from which it was obtained.

Example.

A cow gives 20 lb. of milk in the evening and 30 lb. in the morning. To obtain an accurate mixed sample from this cow it would be necessary to take from the morning's milk one and one half times the amount taken from the evening's milk. If using a two ounce sample bottle, it is convenient in calculating the amount of the sample to be taken from the night's milk to use a definite number of c.c. per pound of milk produced, to bring the night sample as close as possible to 20 c.c. Then it will be found that the quantity of milk produced by the cow the following morning will give a sample which will be contained comfortably in the two ounce bottle. Hence, in the above example, it would be necessary to take 1 c.c. per lb. of milk produced and the quantity of the evening and morning samples would be 20 c.c. and 30 c.c., respectively. If the cow gives 7 lb. in the evening, it will be necessary to take 3 c.c. per lb. of milk and the sample will be 7 x 3 = 21 c.c.; if the following morning she gives 9 lb., the quantity of the morning sample will be 9 x 3 = 27 c.c., making the total of the composite sample 21 plus 27 = 48 c.c.

In taking composite samples of daily supplies to factories of mixed herd milk, it may be found that the quantity delivered daily by each supplier will vary by only a few pounds, and, if this is so, the same quantity sample may be taken each day. If, however, any great variation occurs, it is necessary that the quantity of the sample should vary accordingly.

Composite samples are prevented from curdling by the addition to the first small sample taken of a few drops of Formalin (40% solution of formaldehyde in water). This, however, has the effect of decreasing the solubility of the solids not fat, which may result in a curdy fat column in the finished test. Consequently, as little formalin as possible should be used, depending on the size of the sample and the length of time it has to be kept. One drop of formalin, placed in the samples of evening milk for the purpose of herd recording, is sufficient to keep the milk sweet over night in hot weather.

Formalin is a poison, and should always be labelled as such.

Sample bottles should always be scrupulously clean and are most conveniently cleaned immediately after emptying.

THE BABCOCK TEST FOR CREAM

Cream may be tested by the Babcock method in a somewhat similar manner as for milk. The results are accurate when the necessary care has been taken in sampling the cream and measuring the fat.

Fig. 2.—Diagram showing the heights to which creams of varying fat content must be raised in the pipette to get the same weight of each.

The composition of cream varies greatly according to the operation of separators, temperature and composition of milk, etc.; the fat content of supplies delivered to butter factories in this country usually ranges from 30 to 50 per cent. Because of this wide variation, and for other reasons mentioned below, the measuring of cream for the Babcock test is inaccurate, and correct results can therefore only be obtained by weighing the sample to be tested.

The specific gravity of cream is lower than that of milk, and varies according to its butterfat content; *e.g.*, the more fat the cream contains, the less a certain quantity of it will weigh.

Cream is more viscous than milk, and more of it will adhere to the sides of the pipette, especially in the case of very thick cream; also, in the case of freshly separated cream, air will be present incorporated during the separating process. With ripened cream fermentation gases developed are held in the cream. Hence, in either of the latter two cases, the weight of a certain measure is diminished. Fig. 2 shows the height to which creams of varying fat content must be raised in the pipette to get the same weight of each.

The Dairy Industry Act in force in Western Australia provides that "the butter fat content of cream purchased for the manufacture of butter shall be estimated by the Babcock method and that the samples to be tested shall be weighed with an approved scale." The technique of the cream test is as for milk, except that a 9-gram sample is taken in place of the 18 grams used in the milk test, and as the basis of the Babcock test is an 18-gram sample, and the graduations on the neck of the bottle are calculated on this basis, the final butterfat reading is doubled.

Apparatus.

The apparatus used in the cream test is as for milk, substituting cream flasks graduated 0-30 in place of the milk flasks, and using a special cream balance for weighing the samples.

Sampling.

The cream to be sampled should be well stirred to ensure an even distribution of the butter fat. This is facilitated by the use of a metal stirrer having a mushroom end which will ensure thorough mixing. In taking the sample, it is the practice in butter factories in this State to use a "thief" sampler. This is constructed on the principle of a syringe and cuts a core of cream right through the contents of the can. This core is then readily transferred to the sample bottle by pressure on the plunger.

Weighing the Samples for Testing.

The special cream balance should be set up on a firm bench, and levelled by means of the adjusting screws. This balance is a delicate mechanism, and should be kept clean and bright, with the knife edges working freely to ensure accuracy. The cream test flasks are then placed in the balance trays and the scale is balanced by adjusting the small weight provided on the beam.

The samples should be heated to a temperature of 100-120°F. by placing them in warm water; this is done to ensure ease of weighing.

When the cream is thoroughly liquified, the first sample is shaken vigorously, and having first placed a 9 gram weight on one of the balance trays, the sample is immediately transferred by means of a pipette from the sample bottle to one of the cream flasks on the opposite side of the scale. The beam of the balance is now brought to rest on the supports, the 9 gram weight is removed from the tray and the second sample is balanced against the first. Each tray on the balance holds six flasks and the above procedure is repeated until all 12 samples have been weighed. In this manner, the sample numbers will be arranged with the odd numbers on one tray and the even numbers on the other and, as most factories are equipped with steam turbine centrifuges holding 36 flasks, it is customary to weigh and test the samples in batches of this number. After weighing, the samples are arranged in trays holding 36 flasks and approximately 9 c.c. of warm water is added to each flask and mixed with the cream. The mixing may be done by shaking all flasks together in the tray.

Adding the Acid.

Fifteen to 17.5 c.c. of acid is used. The amount depends on the quantity of fat in the cream, and can only be determined by observation. The colour of the mixture is the best guide, coffee brown being correct, light brown not sufficient, and black indicating too much acid used. Samples appearing too light in colour after mixing can be corrected by the addition of a little more acid and further mixing.

Owing to the "solids not fat" content of cream being lower than that of milk, the colour of the mixture will appear light at first, and it is advisable not to whirl at once after mixing but to allow the bottles to stand for five to 10 minutes until the colour change is complete.

The flasks may now be placed in the centrifuge and the procedure from this point is similar to the milk test until the stage of reading the fat column is reached.

Alternative Method.

A modification of the preceding method is given below and is preferred by some operators for the reason that where large numbers of tests are carried out daily, a considerable saving in quantity of acid and time is achieved.

Some experience is necessary, however, with this method to enable clear fat columns to be obtained regularly.

1. Weigh 9 grams cream.
2. Add 9 c.c. sulphuric acid. Mix and allow to act.
3. Add 7-9 c.c. of hot water.
4. Whirl five minutes.
5. Add hot water to top of neck.
6. Whirl one minute.
7. Place in water bath.
8. Read.

Where steam turbine centrifuges are used, errors due to expansion of the fat may occur if the centrifuge is allowed to get too hot. Very hot tests should be cooled to 140°F. for at least three minutes before reading to obtain correct results. Conversely, using hand operated centrifuges in cold weather, tests should be placed in hot water (temperature 180°F.) for a few minutes in between whirlings, and then placed in the water bath (temperature 140°F.) for three minutes prior to reading.

Reading the Cream Tests.

Fig. 3 shows the correct method of reading the fat column in cream tests, the reading being taken from the bottom of the fat column to the **bottom** of the meniscus. This reading is doubled to give the percentage of fat.

Other precautions to be observed for the correct measurement of the fat column are the same as in the milk test.

If the cream test illustrated in Fig. 3 is examined, it will be found that the bottom of the fat column is on the 2.5 mark and the bottom of the meniscus is on the 22.5 mark.

22.5 — 2.5 = 20

20 x 2 = 40% of butterfat in the sample tested.

Relation between the quantity of cream **taken and the graduated portion of the neck of the 18 gram 30% cream flask.**

Capacity of the graduated portion .... = 6 c.c.

30 graduations, each one .... = .2 c.c.

Specific gravity of butterfat at 140°F. .... = .9

Therefore, weight of fat in each division = .2 x .9 = .18 grams; .18 grams = 1% of 18 grams.

As the weight of the sample used is 9 grams, the reading must be doubled.

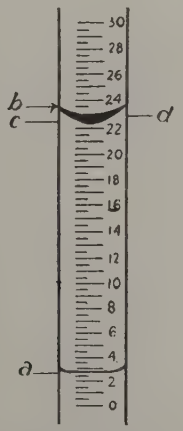


Fig. 3.—Correct method of reading the cream test. Read from a to c.

Eliminating the Meniscus in Cream Tests.

The meniscus in cream tests may be eliminated by the use of coloured glymol. Glymol is a white oil, lighter than butterfat, usually coloured red with Alkanet root. When added to the cream flask it levels off the top of the fat column giving a straight line at the top as well as the bottom, thus removing any doubt as to the point at which the reading should be taken.

Glymol should be added carefully by means of a pipette and allowed to run gently down the inside of the neck of the flask. If it falls directly into the fat column, it will sink into the liquid fat and, on rising, will carry some of the fat on its surface, thus decreasing somewhat the length of the fat column and giving low readings. Reading should be done immediately the glymol is added. If left, the colouring matter will combine with the surface fat, making accurate reading difficult.

The quantity of butterfat contained in a definite amount of cream is calculated as follows:—

$$\frac{\text{Weight of cream in lb. x test}}{100} = \text{lb. of fat.}$$

Hence a can containing 48 lb. of cream testing 43% would contain—

$$\frac{48 \times 43}{100} = 20.64 \text{ lb. of fat.}$$

THE BABCOCK TEST FOR SKIM MILK AND BUTTERMILK

As mentioned previously, the Babcock test was designed originally for the estimation of fat in milk and such milk products as cream. For this purpose it is reliable. When used for testing the industry's by-products (skim milk and buttermilk) the results have been found to be considerably below those obtained by gravimetric analysis, i.e., extraction with ether and weighing the fat. Early attempts at testing skim milk and buttermilk were made by using the ordinary 10% 18 gram milk test flask, but these were found to be of no value for the reason that the fat appeared merely as a few dots in the neck of the flask, and could not be measured accurately.

Later the double-bore skim milk flask (illustrated in Fig. 4) was designed, and proved very convenient for the purpose. Its use has been adopted in all countries where the Babcock test is favoured. These flasks are graduated 0-25, the space between each two marks representing .01%, and the total graduated portion .25%.

The construction of these flasks for use in Britain, as laid down by the British Standards Institution, provides for the graduated portion of the neck to contain 50 divisions, each one representing .01% and the total .5%.

Fig. 4.—Double bore skim milk flask.

The American Association of Creamery Butter Manufacturers during its study of losses of fat in buttermilk devised a test for the accurate determination of fat in buttermilk which has since been adopted as suitable also for skim milk.

The American Association Test.

This method of estimating the percentage of fat in skim milk and buttermilk makes use of a small amount of normal butyl alcohol in addition to the sulphuric acid, to promote a more ready separation of the fat from the mixture in the test flask.

Normal butyl alcohol is free from impurities and, being quite stable, is not likely to be attacked by the sulphuric acid. It does not possess a pungent or offensive odour or flavour and is more pleasant to use than other alcohols.

Directions for Making the Test.

Apparatus.

Double-bore skim milk flasks.
9 c.c. pipette for milk.
2 c.c. pipette for n-butyl alcohol.
Other apparatus is as for testing whole milk.

Place 2 c.c. n-butyl alcohol in the test flask and to this add 9 c.c. of the well-mixed buttermilk or skim milk to be tested. The temperature at sampling should be 65-70°F. Add 7-9 c.c. sulphuric acid, varying the amount to obtain a resultant fat column golden yellow in colour.

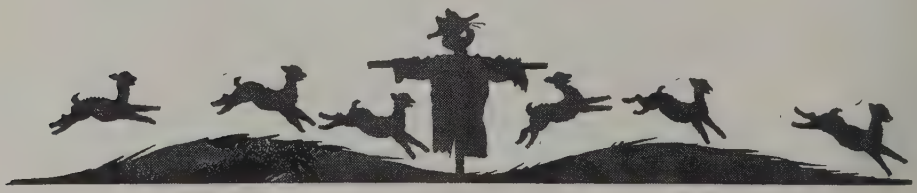
The contents of the flask are then mixed thoroughly, the flask is placed in the centrifuge and whirled at full speed for six minutes. Hot water is then added to fill the flask almost to the base of the neck, and a further whirling of two minutes is given. More hot water is added to float the fat into the graduated neck, and the flask again whirled for two minutes.

The reading is done at a temperature of 130-140°F., and the result is doubled to give the percentage of fat.

When the double-bore flask is used, it should be placed in the centrifuge with the large filling tube to the centre, so that all the fat will gather freely in the calibrated neck.

In performing the Babcock test on any milk product it is important that the water used for floating the fat into the neck of the flasks should be of a soft nature. Foam appearing on the surface of the fat column makes accurate reading difficult and is caused by the action of the acid on impurities (usuall carbonates) in hard water.

If soft water cannot be obtained, the boiling of hard water will often correct the trouble, due to the fact that most of the carbonates which cause foaming will be precipitated.



ROADS ERODE

By B. a'B. MARSH, B.Sc. (Agric.), Adviser, Soil Conservation Service.

THERE is no wheatbelt farm in this State without eroded roads or tracks! That might appear to be a sweeping statement—but pause a while and consider your own property. On how many chains of your farm roads are you controlling the water in a practical manner?

Most of the tracks on your property are formed by nothing more than the continuous passage of vehicles over the same ground.

Soil in wheel marks becomes depressed, the ruts collect water and on sloping ground the running water gradually—and sometimes suddenly—deepens the ruts.

When these become too deep or rough, do you fill them in or do you merely move the track a few yards to one side, accentuating the erosion hazard?

EROSION HAZARD

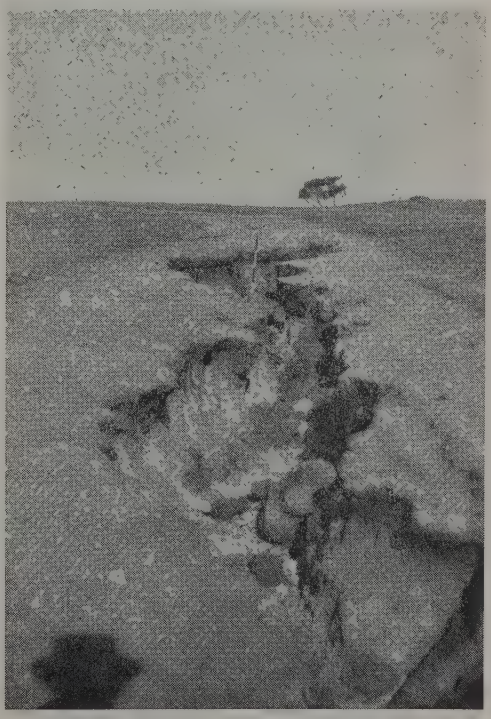
This problem of road erosion is serious because of its widespread nature. Apart from appearances, vehicle damage and impassability in wet periods, the Soil Conservation Service is concerned because the concentration of water by farm tracks is a serious hazard, also, while carrying out advisory work, the S.C.S. officers have to drive over those tracks.

Public road-making authorities are usually able to keep surplus water off their road surfaces; your farm tracks can be treated in the same way to achieve the same results. Notice on your next trip to town how water is controlled on public roads.

Firstly, the road is formed into a crown by the use of graders. The initial formation has to be carried out by powerful machines, the small road patrol graders and grader-ditchers being unsuitable except for maintenance. On the farm, the disc plough will move enough soil in about six or more rounds to give you a reasonably good formed road. Better still, try to hire a 70 h.p. or larger road grader.

This formation of a road is cheaper than you think. At 10s. to 15s. a chain, how much would it cost you to form safe roads on your property?

Notice also, that at short intervals downhill, there are small drains which divert water to the side of the road. These are safety valves which prevent large quanti-



This eroded gully was started by a farm track. It represents a major problem in soil conservation to-day, but a little attention to satisfactory drainage of the track would have prevented the gullying.

ties of water from accumulating on the road surface. If these small outlet drains are blocked—and they frequently are—too much water flows to the bottom of the hill, causing damage to roads and paddocks.

Culverts, pipes and spoon drains prevent water from collecting on the uphill side of formed roads.

By studying the public roads you can see what is applicable to the tracks on your farm.

CONTOURS

Though you won't see public roads built on the contour, roads built in this manner may have some use on the farm where soil conservation contour farming is practiced. Contour roads should be situated below contour banks as the banks then protect the roads from running water.

All roads cannot be built on the contour as many have to travel uphill. Water control is easier when roads travel **directly** uphill. In such a case, water flowing to the side drains of a formed road can be diverted to grassed strips on either side.

Think about it.

Can you afford to leave your roads in their present condition?

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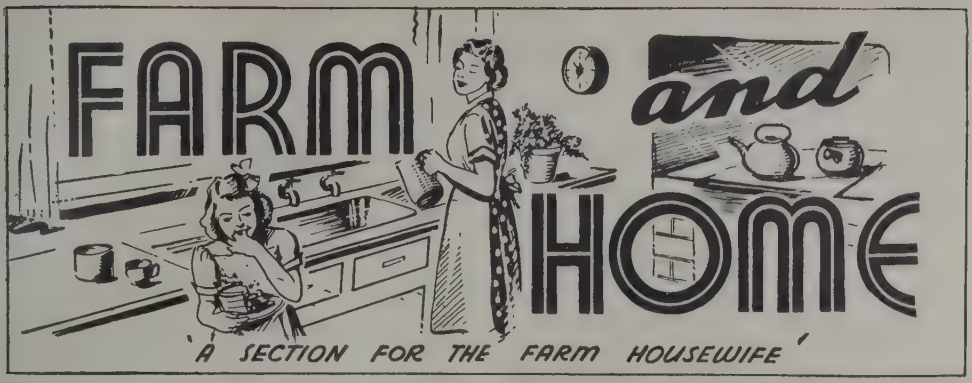


Some Ideas in Plastic

By BRENDA CLEEVE, Home Science Teacher, Department of Education.

THE plastic sheeting, which is now available in many weights and patterns, is a highly versatile material which lends itself to a number of uses in the home. Here are a few suggestions.

For the expenditure of a few shillings and a little time, a plastic wardrobe can be made easily and quickly. It will be found ideal for storing those filmy evening dresses or the silks which always seem to be a nuisance in the wardrobes when mixed up with every-day clothes.

The plastic covers not only keep them compact and free from "snagging" but also protect the fine fabrics from dust which soon destroys their freshness.

For the traveller or holiday maker, a plastic wardrobe is a particularly handy accessory, for how rarely are we fortunate enough to find adequate wardrobe space in holiday resorts and hotels, especially when we are compelled to take along winter clothes which require a lot of space?

MAKING THE WARDROBE

For preference choose a light-weight plastic to avoid placing too much strain on the shoulder lines of summer dresses. Material 30in. wide is the most economical width to buy, and a transparent material is preferable as removable of garments from the cover is facilitated when they can be seen clearly.

To make the plastic wardrobe, allow twice the length of the garment for which it is required plus 4 to 6in. extra for the box top. In the case of evening dresses, unless the material is firm, it is best to hang them from the waist in order to avoid stretching the bodice out of shape.

The width of the top portion may be increased so that several dresses or garments may hang inside the one cover.

The diagram shows how the material should be cut before joining up. It will be noted that three yards of material are used and this will effectively cover an overcoat for the average sized person. The width of the box sides and top (in this case 5in.) may be increased or decreased according to the type and number of garments to be covered.

JOINING THE SEAMS

Plastic may be joined by fusing or machining. Fusing, by means of heat, is generally preferable to machining as the stitches are liable to cut the material. In

fusing, the two edges or portions to be joined are placed together and covered with a layer of paper. The heel of an iron is then drawn down the edges to be joined. The temperature required to fuse the plastic varies considerably with the type of material being used. Some require a fairly hot iron while others will only stand a low temperature. It will be necessary to make a few trial seams before embarking upon the main task.

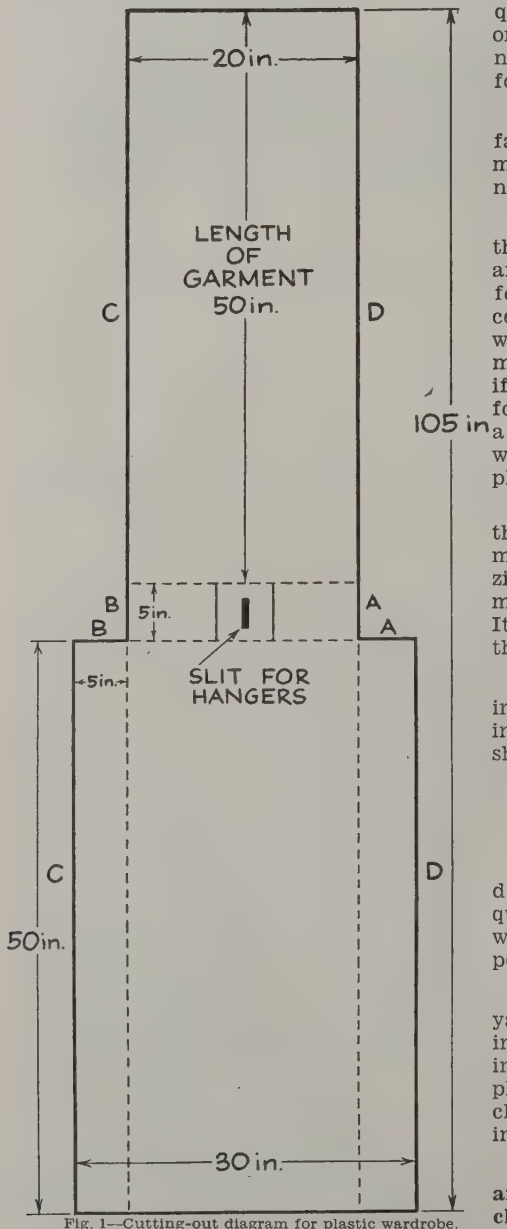


Fig. 1—Cutting-out diagram for plastic wardrobe.

If fusing cannot be carried out satisfactorily, sew the seams on the sewing machine, using a large stitch and a fine needle.

To complete the wardrobe shown in the diagram place AA and BB together and join, then join CC and DD. The slit for the hook on the coat-hanger in the centre of the box top is best reinforced with an extra thickness of plastic. This may be fused or machined in place but if fusing is carried out it should be performed very carefully as it is easy to take a piece out of the surrounding material while putting the extra thickness in place.

If it is desired to close the bottom of the plastic wardrobe, attachments may be made to fasten this with tie-strings or a zip. If a zip is used, employ the same method as when sewing a zip into a dress. It is a wise plan to reinforce the sides of the cover before attaching the zip.

For a gent's wardrobe, the width given in the diagram (20in.) may need to be increased to give extra width across the shoulders.

LAUNDRY BAG

In hot weather when clothes damped down for ironing are apt to dry out very quickly, a bag made from plastic material will retain the moisture for an indefinite period.

A suitable bag can be made from $1\frac{1}{3}$ yards of 27in. sheeting. Fold the plastic in halves and join the two sides by fusing or stitching. If you use transparent plastic for the bag you will be able to choose the clothes wanted first for ironing.

A word of warning is necessary if you are using this bag for your dampened clothes. The lack of air encourages the

growth of mildew and should you be unable to iron all the damped-down articles at one time do not leave them in the bag longer than two days.

This type of bag is also ideal for carrying soiled clothes when you are on holidays. It prevents odours of smoke and perspiration from marring the freshness of clean clothes in the suit-case.

Fig. 2—The completed wardrobe. In this case a medium-weight patterned material was used. For evening frocks a light-weight transparent plastic is preferable.

HAT BAG

A lightweight plastic bag made as described above is an ideal dust-proof and waterproof container for carrying or storing spare hats. The lightweight plastic is to be recommended as the heavy material tends to flatten delicate flowers and veil trimmings.

ICING BAGS

Plastic icing bags to which the standard nozzles can be attached will be popular among cake decorators who find the metal syringes stiff and awkward to use.

Choose a heavyweight plastic as the thinner types lack body and are not really firm enough to allow the pressure to be regulated and the flow of icing controlled.

Cut a circle out of paper using a large dinner plate for size and fold or measure it so that the circle can be cut into three equal segments. One of these segments is the pattern for the bag.

To make the bag, join the two straight sides, preferably by fusing as the icing tends to squeeze out of the holes made when the plastic is machine stitched.

A patent ring for attaching icing nozzles may be purchased for about 2s. This should be tied firmly to the point of the bag and it may be necessary to cut away the points until the opening is large enough to take the ring. The plastic should fit tightly around the rim of the ring so that the pressure of the icing will not force it out of position.

Should the patent ring be unobtainable, the nozzles may be used without the ring simply by putting the nozzles inside the bag and allowing just sufficient room for the tip of the nozzle to protrude. The nozzle is held in position by placing an elastic band firmly around the threads on the top of the nozzle. A bag made in the same manner but about 12in. long may be used for piping out the mixture for cream puffs, chocolate eclairs and meringues. Leave a hole $\frac{3}{8}$in. in diameter at the top unless you have a cream pipe which may be placed inside the bag.

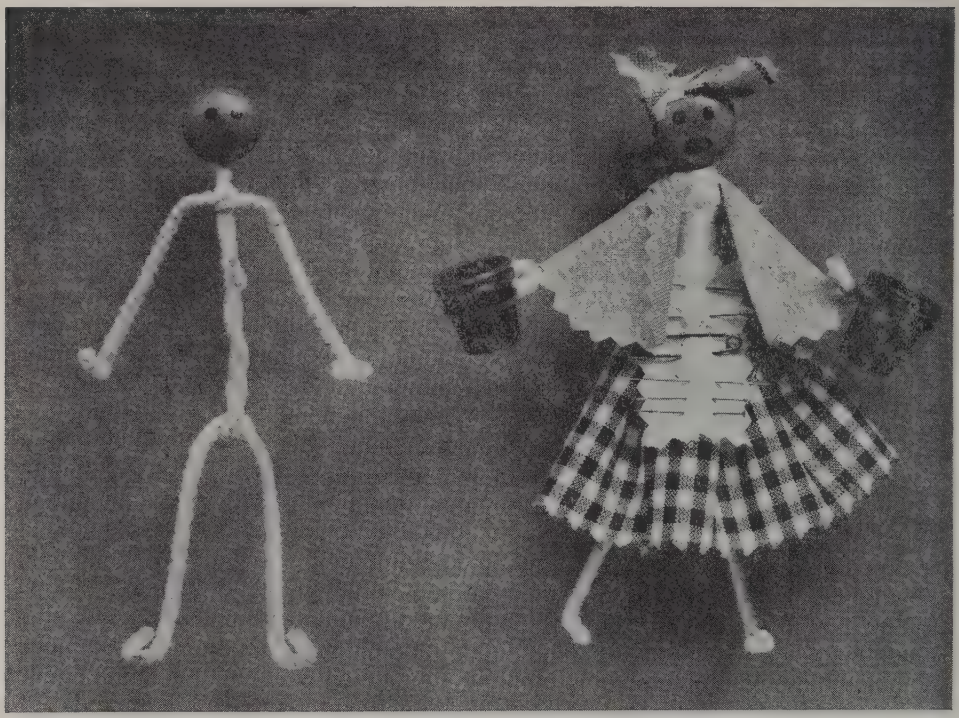


Fig. 3—The "skeleton" of "Needle Nell" is shown on the left, with the completed novelty on the right.

Meet "Needle Nell"

By BRENDA CLEEVE.

"NEEDLE NELL" is a quickly-made bazaar or gift novelty. To make her you need three pipe-cleaners (a packet of eight costs 3½d.), a shank button (i.e., one without holes punched through), two thimbles, a few pins and needles and some small scraps of bright material.

The shank button makes her face. The features are painted on with enamel or, if you want a quick result, use bright nail polish. If a shank button is not available, cover a flat button with a scrap of plain material. Just cut a circle of cloth a little larger than the button and gather the edges together, then fasten at the back of the button and work the features in with a few simple stitches.

Place one pipe-cleaner through the shank and fasten the button on one end by bending the cleaner over. For the arms take another cleaner and bend in two. At each end bend ½in. of the cleaner round to form a ring. These rings form the hands. Place the arm piece over the body with the centre point below the rim of the button, leaving a small length for a neck. Fasten by crossing the arms to the opposite sides.

The legs are shaped in the same manner as the arms using the third cleaner. Fasten them to the end of the body cleaner by bending and twisting the cleaners.

"Needle Nell's" clothes consist of a skirt, cape and apron. To make the skirt take a piece of material about 3in. x 6in. and join the short sides. Run a gathering thread around one edge, draw together and fasten into position on the body.

To form a bodice, wind a length of bias binding or ribbon around the top body section to cover up the cleaners.

The pattern for the cape is made from a piece of paper cut the size of a small saucer and divided in halves. Wrap this semi-circular piece (cut in cloth) around the shoulders and catch in front with a few small stitches.

If the button forming the head has a sharp rim, conceal it by tying a strip of material around it, finishing with a bow on top. Keep it in position with a dab of glue or clear nail polish.

The apron is simply a piece of white material about 1in. x 1½in. held in position with a pin.

To finish off, place a few pins, needles and brass safety pins down the front of the apron. Place small elastic bands around the tops of two coloured plastic thimbles and fasten one to each hand, to simulate milk pails. A larger elastic band may be tied around the neck and forms a loop for hanging.

An attractive finish to the clothes is provided by a pinked edge. If pinking shears are not available, the edges may be fringed by withdrawing a few threads.

SPECIMENS HELP DIAGNOSIS

WRITTEN descriptions of plant diseases are often insufficient for accurate diagnosis. Send specimens, preferably several, showing the disease at various stages. They will usually carry well if wrapped in moist newspapers and enclosed in well-ventilated containers.

DUSTING OF POTATOES

ONLY the derris preparations as recommended by the Department of Agriculture should be used for dusting stored potatoes to guard against insect pests. Full particulars concerning the use of recommended dusts can be obtained from the Vegetable Branch of the Department of Agriculture.

This was emphasised by the Director of Agriculture (Mr. G. K. Baron Hay) who said that the use of insecticidal dusts containing DDT and BHC (benzene hexachloride) contravened regulations under the Agricultural Products Act and the Public Health Act.

Mr. Baron Hay said that the derris dusts are harmless to human beings and, until experimental work now being undertaken provides convincing evidence that other dusts are not likely to endanger human health, derris dusts were the only ones that could be recommended by his Department.

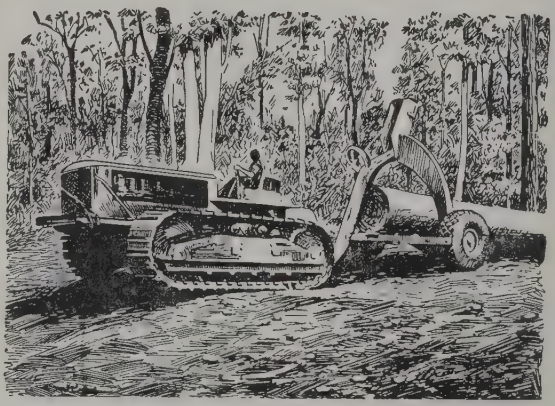
CERTIFIED "WESTRALIA" BEAN SEED

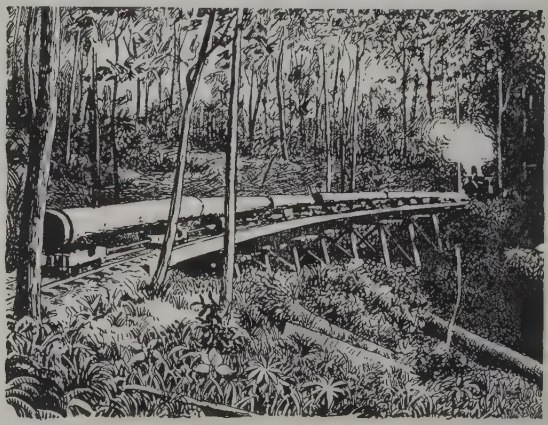
THE "Westralia" rust-resistant pole bean variety which was bred by the Western Australian Department of Agriculture, has become very popular commercially, and every effort is being made to ensure that certified seed is maintained at a high standard.

Crops of "Westralia" submitted for seed certification are inspected by Departmental officers during growth to ensure trueness to type and freedom from disease, and finally the harvested seed is tested for purity and germination.

Recently crops grown for seed certification purposes were inspected for disease freedom by Senior Plant Pathologist H. L. Harvey with gratifying results. Although the prescribed tolerance for mosaic, a seed-borne virus disease, is very low, the amount observed was less than 0.5 per cent., which is well below the permissible limit. Other diseases such as bacterial blight, were virtually absent.

STATE SAW MILLS AND BRICK-WORKS





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EXPORT LAMB CARCASS COMPETITION

Western Australia Leads The Commonwealth

By N. DAVENPORT, B.Sc. (Agric.), Agricultural Adviser.

A WEST Australian export lamb breeder, Mr. M. K. Reynolds, of Meckering, gained first and fourth places in the West Australian Export Lamb Championship Competition decided after the 1952 killings. Later, his winning entry was awarded the All-Australian Championship when the carcasses were judged at Smithfield by Mr. G. F. Way, a highly qualified and experienced member of the London meat trade.

Western Australia can feel justly proud of its success in this competition. The results must give further impetus to an important industry and also provide an incentive to growers to take part in the competition, quite apart from the high value of the prizes given.

State-wide competitions for export lamb carcasses were first conducted by the Australian Meat Board in this and other States in 1937. The competitions were interrupted by the war but were resumed in 1948 and have been held every year since.

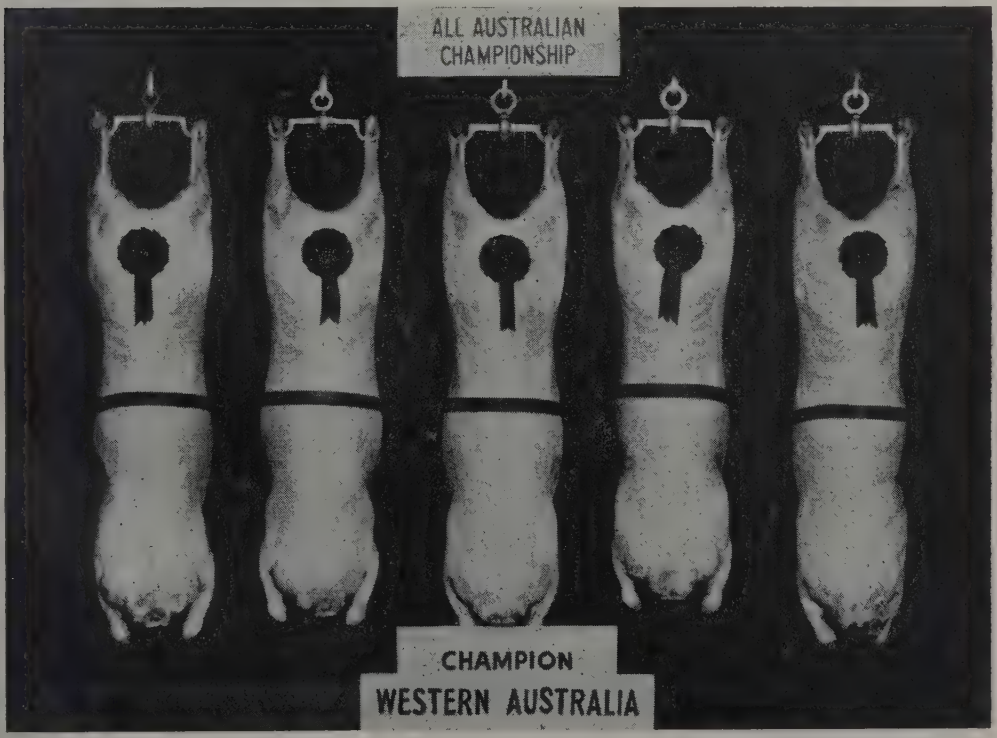

Fig. 1.—Mr. M. K. Reynolds's entry which won the All-Australian Championship, 1952 season.

The principal objects of the competitions were to foster the production of high quality lamb suitable for the English market and to keep buyers aware of the high quality of lambs from Australia. After each killing season, all lambs entered and accepted for competition have been shipped to England where they were the subject of a special advertising display made on a State basis at the Smithfield Meat Market.

STATE COMPETITIONS

Since 1948, inclusive, the competition has been for two classes of lamb:—

Class 1 for lambs sired by Southdown rams.

Class 2 for lambs sired by rams of any other British breed.

For each class the ewes must not be entirely of British breed blood, in other words they must not be of one British breed nor of a cross between two British breeds but may be cross-breds, comebacks, Corriedales, Polwarts or Merinos. The rams must be flock rams from flocks registered in the recognised flock books. Lambs must be bred by the entrant.

The restriction of Class I to lambs sired by Southdown rams recognises the superiority of this breed in producing the highest quality lambs. The lambs of practically all the entrants are out of half-bred longwool-Merino ewes as these have been found to be the most satisfactory producers of export carcasses.

In order that the lambs should be competing under reasonably similar condition of production, the agricultural districts were divided into zones for Class I as follows:—

Zone 1 consisting of the Northern, Eastern and Great Southern Districts.

Zone 2 consisting of the Midlands District.

Zone 3 consisting of the Central Districts.

Zone 4 consisting of the lower Great Southern and South-West Districts.

No zone was made for Class 2.

Entrants in each zone compete for the Zone Competition and the first and second prize-winners then compete for the State Championship which carries a prize of £30 and a trophy valued at £15.

INTERSTATE COMPETITION

The four leading entrants in each State are regarded as the entry for that State in the Interstate Competition for which the prize is a trophy valued at £50 for perpetual competition. This trophy is held by the Department of Agricture in the winning State for one year.

Fig. 2.—The trophy for the Interstate Competition.

Prizes, in addition to those won in the State Competition are given and these are £10 for first; £5 for second; £3 for third, and £2 for fourth placings.

This State's entrants showed up to considerable advantage in the first year of the competition (1952). The West Australian entry won the Interstate Competition and this State now holds the trophy until the results of the next competition are announced.

The four entrants comprising the winning team are given below together with their point scores.

First—Mr. M. K. Reynolds, of Meckering (English Leicester-Merino x Southdown), 458 points.

Second—Mr. J. P. Reynolds, of Meckering (English Leicester-Merino x Southdown), 436 points.

Third—Mr. A. N. Rischbeith, of Mt. Barker (Romney Marsh- Merino x Southdown), 401 points.

Fourth—Mr. M. K. Reynolds, of Meckering (English Leicester-Merino x Southdown), 400 points.

This gave a total of 1,695 points for Western Australia which topped the interstate entrants. Victoria followed with 1,659 points and next in order were South Australia with 1,637 points, New South Wales with 1,542 points and Queensland 1,405 points.

ALL AUSTRALIAN CHAMPIONSHIP

The highest scoring entry in the West Australian team—Mr. M. K. Reynolds's entry which scored 458 points—gained the All-Australian Championship. It was closely followed by the entry of Mr. E. F. Hancock, of Warracknabeal, Victoria, which scored 439 points.

The judge referred to the West Australian exhibits as:—

"A grand entry of a uniformity, conformation and quality of flesh which made the exhibit a very pleasing one to the trade, winning for itself first place in the Interstate Competition."

A report on Mr. M. K. Reynolds's winning entry said:—

"The trade experts generally agreed that the pen placed first in the W.A. competition was of exceptionally high standard and one of the finest ever brought out of Australia. This pen could hold its own for quality against any exporting country."

To have won the All-Australian Championship is a tribute not only to Mr. M. K. Reynolds but to the Meckering district as well. It is a compliment both to the breeding of the entries and to the practice of pasture improvement with subterranean clover which has been carried out in this district over the past 15 years. These advanced practices have been due in a very great measure to the activities of the Meckering Pasture Improvement Group over many years.

Three out of the four pens comprising the State team for the Interstate Competition were bred in an area with a 15in. annual rainfall average. This confirms our past experience that practically the whole of our early subterranean clover districts are capable of producing high quality lamb that is well suited to the English market and capable of competing favourably with the other exporting countries. The competitions have demonstrated that Western Australia is capable of holding its own with producers of export lambs in other parts of the Commonwealth.

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THE BREEDING OF FARM ANIMALS

CONTROLLED breeding is an important factor in successful stock-raising. It affords opportunities of increasing the sizes of flocks and herds without the risks attendant upon outside introductions. In enables the stockowner to improve the quality of his animals in successive generations, and is the source of saleable surpluses or animals to replace those culled for various reasons or lost through accident or disease.

Fertility, which might be defined as the ability to breed freely, safely and regularly, is influenced, in the first place, by the inherited characters handed down to an animal by its ancestors. A pig, for instance, which was itself a member of a large litter and whose ancestors had consistently produced large litters over many generations would be likely to become the sire or dam of other large litters, especially if mated to an animal with a similar record of prolificacy.

In other animals, the tendency to produce twins appears to be hereditary.

Feeding, however, has an important influence on fertility, while climate, exercise and other factors all play their parts.

OESTRUM OR HEAT

Reproduction in the mammals is dependent upon the fertilisation of the female egg cells or ova by the male sperm cells or spermatozoa.

Before this can occur, the ova or egg cells must reach full development in the ovaries and pass down the oviduct into the uterus or womb. During this process, which occurs at regular intervals, the female shows sexual excitement and a desire to mate. This is usually referred to as the "heat period" or oestrum.

The frequency of the heat period varies with the different species of animals and may differ in individuals of the same breed. The heat periods, except in rare instances, cease when conception takes place but are resumed again after the animal has given birth to young.

Cows have a heat period lasting 1 to 4 days, which occurs about every 21 days if conception does not take place. A cow "returns to service" about 21 days after calving.

Mares have a heat period of 5 to 7 days recurring every 21 days. Oestrum recurs about 28 days after foaling.

Ewes have a heat period of ½ to 2 days, which occurs every 14 to 19 days. After lambing, oestrum does not recur for about 4 to 6 months.

Does (goats). As for ewes.

Sows have a heat period lasting 2 to 4 days, recurring about every 21 days. Sows frequently come into heat 3 to 4 days after farrowing but it is not advisable to permit mating until the second period.

Bitches have a heat period lasting 7 to 21 days—usually about 14 days—and this occurs at intervals of about 6 months. After whelping, the bitch usually goes five or six months before the next heat period commences.

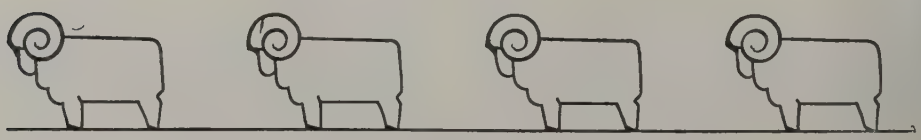
GESTATION

The gestation period—the time elapsing between conception and parturition or giving birth—varies according to species. Mares take about 11 months, cows about 9 months, ewes and does about 5 months; sows about 4 months and bitches about 2 months.

A fairly wide variation between individuals is not uncommon but the following table gives a useful guide to parturition dates according to the time of service. The gestation periods shown may be taken as a fair average for the species named.

BREEDING TABLES

Time of Service.	Mares 340 days.	Cows 283 days.	Ewes 150 days.	Sows 112 days.	Bitches 63 days.
January 1	December 6	October 10	May 30	April 22	March 4
,, ... 8	,, ... 13	,, ... 17	June 6	,, ... 29	,, ... 11
,, ... 15	,, ... 20	,, ... 24	,, ... 13	May 6	,, ... 18
,, ... 22	,, ... 27	,, ... 31	,, ... 20	,, ... 13	,, ... 25
,, ... 29	January 3	November ... 7	,, ... 27	,, ... 20	April 1
February 5	,, ... 10	,, ... 14	July 4	,, ... 27	,, ... 8
,, ... 12	,, ... 17	,, ... 21	,, ... 11	June 3	,, ... 15
,, ... 19	,, ... 24	,, ... 28	,, ... 18	,, ... 10	,, ... 22
,, ... 26	,, ... 31	December 5	,, ... 25	,, ... 17	,, ... 29
March 5	February 7	,, ... 12	August 1	,, ... 24	May 6
,, ... 12	,, ... 14	,, ... 19	,, ... 8	July 1	,, ... 13
,, ... 19	,, ... 21	,, ... 26	,, ... 15	,, ... 8	,, ... 20
,, ... 26	,, ... 28	January 2	,, ... 22	,, ... 15	,, ... 27
April 2	March 7	,, ... 9	,, ... 29	,, ... 22	June 3
,, ... 9	,, ... 14	,, ... 16	September 5	,, ... 29	,, ... 10
,, ... 16	,, ... 21	,, ... 23	,, ... 12	August 5	,, ... 17
,, ... 23	,, ... 28	,, ... 30	,, ... 19	,, ... 12	,, ... 24
,, ... 30	April 4	February 6	,, ... 26	,, ... 19	July 1
May 7	,, ... 11	,, ... 13	October 3	,, ... 26	 8
,, ... 14	,, ... 18	 20	,, ... 10	September 2	,, ... 15
,, ... 21	,, ... 25	,, ... 27	,, ... 17	,, ... 9	,, ... 22
,, ... 28	May 2	March 6	,, ... 24	,, ... 16	,, ... 29
June 4	,, ... 9	,, ... 13	,, ... 31	,, ... 23	August 5
,, ... 11	,, ... 16	,, ... 20	November.... 7	,, ... 30	,, ... 12
,, ... 18	,, ... 23	,, ... 27	,, ... 14	October 7	,, ... 19
,, ... 25	,, ... 30	April 3	,, ... 21	,, ... 14	,, ... 26
July 2	June 6	,, ... 10	,, ... 28	,, ... 21	September 2
,, ... 9	,, ... 13	,, ... 17	December 5	,, ... 28	,, ... 9
,, ... 16	,, ... 20	,, ... 24	,, ... 12	November.... 4	,, ... 16
,, ... 23	,, ... 27	May 1	,, ... 19	,, ... 11	,, ... 23
,, ... 30	July 4	,, ... 8	,, ... 26	,, ... 18	,, ... 30
August 6	,, ... 11	,, ... 15	January 2	,, ... 25	October 7
,, ... 13	,, ... 18	,, ... 22	,, ... 9	December 2	,, ... 14
,, ... 20	,, ... 25	,, ... 29	,, ... 16	,, ... 9	,, ... 21
,, ... 27	August 1	June 5	,, ... 23	,, ... 16	,, ... 28
September 3	,, ... 8	,, ... 12	,, ... 30	,, ... 23	November.... 4
,, ... 10	,, ... 15	,, ... 19	February 6	,, ... 30	,, ... 11
,, ... 17	,, ... 22	,, ... 26	,, ... 13	January 6	,, ... 18
,, ... 24	,, ... 29	July 3	,, ... 20	,, ... 13	,, ... 25
October 1	September 5	,, ... 10	,, ... 27	,, ... 20	December 2
,, ... 8	,, ... 12	,, ... 17	March 6	,, ... 27	,, ... 9
,, ... 15	,, ... 19	,, ... 24	,, ... 13	February 3	,, ... 16
,, ... 22	,, ... 26	,, ... 31	,, ... 20	,, ... 10	,, ... 23
,, ... 29	October 3	August 7	,, ... 27	,, ... 17	,, ... 30
November 5	,, ... 10	,, ... 14	April 3	,, ... 24	January 6
,, ... 12	,, ... 17	,, ... 21	,, ... 10	March 3	,, ... 13
,, ... 19	,, ... 24	,, ... 28	,, ... 17	,, ... 10	,, ... 20
,, ... 26	,, ... 31	September 4	,, ... 24	,, ... 17	,, ... 27
December 3	November.... 7	,, ... 11	May 1	,, ... 24	February 3
,, ... 10	,, ... 14	,, ... 18	,, ... 8	,, ... 31	,, ... 10
,, ... 17	,, ... 21	,, ... 25	,, ... 15	April 7	,, ... 17
,, ... 24	,, ... 28	October 2	,, ... 22	,, ... 14	,, ... 24
,, ... 31	December 5	,, ... 9	,, ... 29	,, ... 21	March 3



BLACKHEAD IN TURKEYS

(Infectious Entero-hepatitis)

By P. M. A. HARWOOD, M.R.C.V.S., Senior Veterinary Surgeon.

INFECTIOUS entero-hepatitis, or blackhead as it is commonly called, is responsible for more deaths among turkeys than any other disease with which the flockowner has to contend. The greatest losses occur in poults up to three months old, but turkeys of all ages are susceptible. Recovery from an attack of blackhead does not necessarily confer a lasting immunity and many recovered birds remain carriers of the disease.

The common name of the disease alludes to a darkening of the head, which may occur owing to failure of the circulation (cyanosis). This symptom does not always appear, however, and frequently the head is pale or yellowish in colour.

CAUSE

Blackhead is caused by a microscopic animal parasite called *Histomonas meleagridis*. While direct transmission may take place from bird to bird through the medium of infected droppings (this being greatly aided by filthy and damp conditions), the minute blackhead parasite can also live inside the eggs of the common blind-gut worm *(Heterakis gallinae)* of fowls. These eggs are very resistant to heat, cold, and other adverse conditions that would normally kill the parasite, and they enable the infection to remain active in the ground for considerable periods.

SYMPTOMS

The birds become drowsy, and stand about with ruffled feathers and drooping wings. **The droppings are liquid and have a characteristic sulphur colour.** Where the birds are sick for two or three days before dying, they waste very rapidly and become extremely emaciated.

In young poults the disease is often rapidly fatal and the birds die almost as soon as symptoms are apparent. The death rate is frequently 100 per cent. In older birds the disease may run a more protracted course, and some birds will recover. There is no seasonal incidence of the disease, which may appear at any time among birds in any age group.

Fig. 1.—A turkey badly affected by blackhead. Note the sunken appearance of the eyes and the drooping wings which are characteristic of this disease.
—(After Durant, University of Missouri).

POST MORTEM SYMPTOMS

The post mortem appearance of the organs of a turkey that has died of blackhead are quite characteristic.

The principal changes take place in the caeca or blind guts. They become severely inflamed and ulcerated, and the

lining membrane is thickened and covered with a foul-smelling exudate. There is a dry core of yellow cheesy material within the cavity of the organs, which may also contain blood.

Very typical changes are also seen in the liver. The surface of the liver is covered by circular depressed yellowish-green areas. These circular areas show concentric rings with slight variations in colour, and when the liver is cut, it is found that they extend deeply into the substance of the organ.

Fig. 2.—The liver of a turkey that died of blackhead. Note the typical circular sunken areas. —(After Graybill, University of California.)

PREVENTION

The first consideration in dealing with the prevention of blackhead is that the organism causing the disease is not normally carried by turkeys, but is a common parasite of fowls, where it only infrequently causes disease.

It must be ensured, therefore, that turkeys have no contact whatsoever with fowls; that they are not allowed to run over land that has carried fowls unless the fowls have been kept off the land for at least twelve months previously, and that the runs cannot be contaminated with drainage from fowl-runs.

The second consideration is that adult turkeys that have recovered from blackhead may become carriers of the disease, and therefore **young turkeys should be kept as severely isolated from adult stock as from fowls.**

Turkey eggs should be artificially incubated, as the turkey hen may be a blackhead carrier, and it is obviously undesirable to use broody fowls to bring off the eggs.

Wet and filthy conditions greatly facilitate the spread of the disease from bird to bird. Brooding should be carried out under perfectly clean and dry conditions, using either battery brooders or clean and disinfected brooders of other types in conjunction with wire-netting floors or dry clean deep litter.

Great care must be exercised that food and water troughs do not become contaminated with droppings and that there are no wet areas around them.

When going on to open range, clean ground that has not carried turkeys or fowls for at least one year, and has not been fertilised with fowl or turkey manure should be used, and even under ideal conditions the concentration should never exceed 75 birds per acre. All wet and boggy areas should be excluded. In view of the fact that the blind-gut worm aids in the transmission of the disease, treatment of all turkeys should be undertaken to eliminate this parasite. A dose of 0.5 grams of phenothiazine should be given, and treatment may be effectively carried out by mixing one ounce of phenothiazine in enough wet mash to treat 60 birds.

To summarise the chief points in prevention of disease:

1. Turkeys should never come in contact with fowls or ground that has carried fowls less than 12 months previously.
2. Young and mature turkeys must be strictly segregated.
3. Artificial incubation and brooding are essential if turkey raising is to be a commercial success.
4. Filthy or damp conditions facilitate the spread of the disease. Strict attention must be paid to scrupulous cleanliness and dry conditions.
5. Treatment should be given to eliminate the blind-gut worm which aids in the transmission and "carry-over" of the disease.

TREATMENT

Once clinical cases appear in a flock of turkeys, it means that the majority of birds are already affected to some extent by the disease, and success can only be achieved by treating the entire flock. This makes treatment expensive.

Even more expensive is the measure commonly adopted of giving drugs continuously through the danger period in order to act as a preventive.

Drugs that are used for this purpose are organical arsenical preparations such as Turk-e-Sun or Stovarsol. While being quite effective as preventives of blackhead, they have proved rather disappointing in the treatment of the condition.

Acetylarsen, an organical arsenic preparation put up in injectible form, is useful both for its preventive and curative action. The drug is administered by injection either into a muscle or a vein. The disadvantages of this type of treatment are that a degree of skill is essential to effect the injection, especially where this is made into a vein, and where large numbers of birds are to be treated, the process is rather tedious.

A very recent innovation in the treatment and prevention of blackhead is a new drug called Entramin (M & B) (2-amino-5-nitrothiazole). When an outbreak of blackhead occurs, Entramin is fed at a concentration of 0.1% of active principle in the mash.

This is effected by mixing Entramin at the rate of 8 ounces of the drug per 112 lbs. of mash.

The cost of the drug for the treatment of turkeys at four months of age works out at approximately ½d. per bird per day, and treatment must be continued for 14 days.

Where large quantities of birds are to be treated, a 2½lb. pack, sufficient to treat 560lb. of mash, is available at an approximate cost of 5d. per bird for 14 days' treatment.

Entramin may also be used as a preventive, by administering half the quantity that would be used for curative treatment.

During treatment of an outbreak with Entramin, all seriously affected birds should be isolated and, if necessary, forcibly fed with the medicated mash.

It is very important that the whole flock be treated at the commencement of an outbreak, and that treatment be continued for 14 days.

In mild outbreaks the drug may be fed for the second 7-day period at the rate of 8 ounces per 224lb. of mash.

It must be stressed that turkey raising cannot be a sound commercial proposition where the birds are run in conjunction or in contact with fowls, as under these conditions losses can only be prevented by medication during the entire life of the bird, and the costs involved by this render the project uneconomical.

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PROTECTION OF SURVEY MARKS

THE Surveyor-General (Mr. W. V. Fyfe) is gravely concerned by the frequency with which survey pegs and other marks are destroyed or removed by farmers during fencing and other operations.

Survey pegs, posts, spikes and other marks are the property of the Crown and are intended to show permanently on the ground, the position of surveyed lines or points.

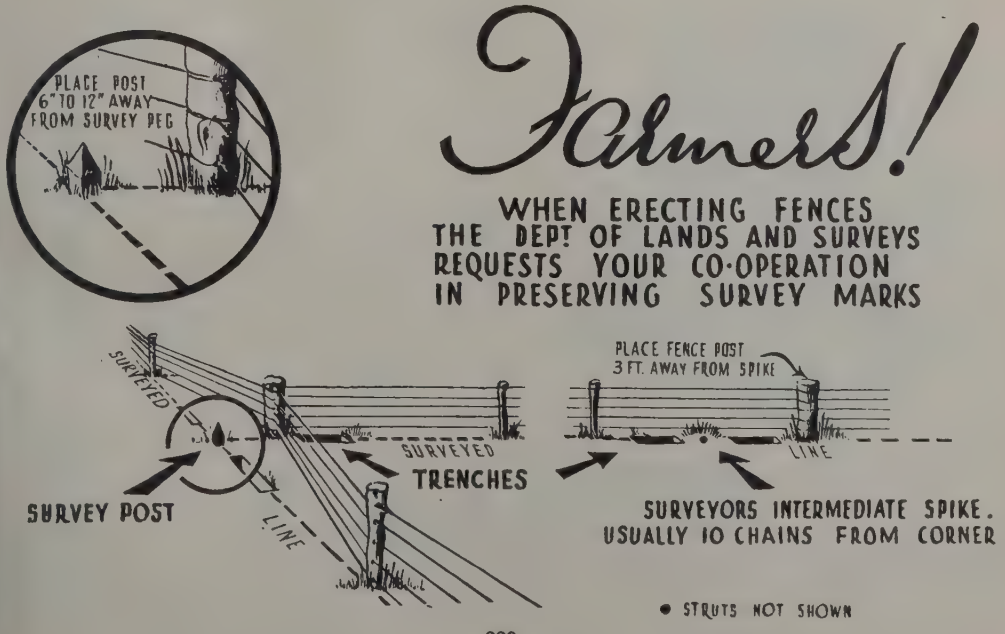
Their removal or disturbance is illegal and penalties are provided under existing law for any interference with survey marks.

It is felt, however, that a wider knowledge of the permanent nature and value of these pegs, spikes, marks, etc., would render prosecutions unnecessary.

Existing survey marks serve as a basis for future work and their removal creates serious difficulties when subsequent surveys are made. If a farmer wishes to sell a portion of his land, for instance, the removal of the original survey marks will necessitate costly re-surveying.

The cost of such work to land-owners, local governing bodies and Government authorities has, in many cases, been particularly heavy.

The Department of Lands and Surveys would welcome the co-operation of farmers and others in protecting existing survey marks and offers suggestions indicated in the sketch for leaving these marks intact when erecting fence-lines.



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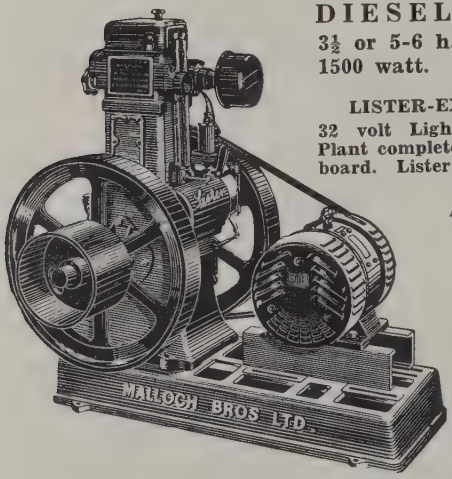

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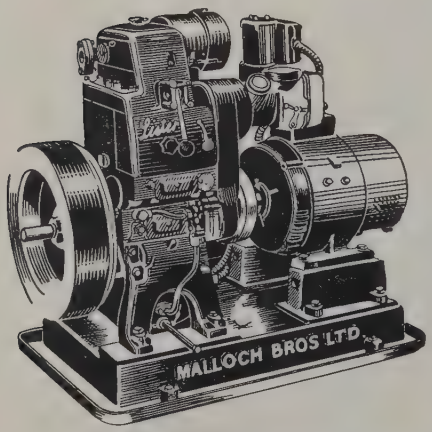

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50-54 WILLIAM ST. PERTH

WHALE BY-PRODUCTS FOR PIG FEEDING

By K. M. HOPE, B.Sc. (Agric.), Agricultural Adviser,
V. E. WESTON, H.D.D., Manager, Denmark Research Station, and
P. GARSTONE, M.D.A., Pig Husbandry Instructor, Muresk Agricultural College.

PIG feeding experiments at Denmark Research Station and Muresk Agricultural College in 1951 and 1952, were designed to investigate the value of whalemeal and whale solubles in comparison with meatmeal as protein supplements to a crushed wheat ration. Large quantities of whale solubles are available and, used efficiently, could greatly reduce the present shortage of protein supplements.

From the pig raiser's viewpoint the most important findings are:—

1. Whalemeal and whale solubles can be fed successfully to pigs.

2. In the trial at Denmark in 1951 whalemeal proved equal to Midland meatmeal.

3. In the same trial and others carried out at the Muresk Agricultural College, whale solubles proved a satisfactory protein supplement but was slightly inferior to Midland meatmeal and whalemeal.

4. The best feed conversions (from 3 to 3½lb. of feed per lb. of liveweight gain) were obtained from rations containing a high proportion of protein. These rations contained the equivalent of ½lb. Midland meatmeal per pig per day from weaner to baconer or ½lb. whalemeal or 9oz. of whale solubles. These supplements were fed with crushed wheat used at the rate of 1lb. per day per each 30lb. liveweight of the pigs.

This provides a ration in which the crude protein content is gradually reduced from 18% when the pigs are 60lb. to 13% when they are 180lb. liveweight.

5. Whale solubles were inferior to meatmeal when small quantities were used in conjunction with dried brewer's grains to give a combined animal protein —plant protein supplement to crushed wheat.

6. The combined whale solubles—meatmeal mixtures equalled Midland meatmeal as protein supplements to crushed wheat.

7. Whale solubles can completely replace meatmeal after 100lb. liveweight without any loss in performances.

8. Both whalemeal and whale solubles can be fed as the sole protein supplement to a crushed wheat ration from weaner to baconer without any harmful effect on the quality of pigmeat produced. All pigs presented attractive carcasses which graded well on appraisal and were highly commended by bacon curers.

DENMARK EXPERIMENT, 1951

All groups on standard crushed wheat ration at 1lb. per 30lb. liveweight plus following protein supplements. Pigs fed in pens.

A. 8oz. Midland meatmeal per pig per day.
B. 8oz. Babbage Island whalemeal per pig per day.
C. 6oz. Point Cloates whalemeal per pig per day.
D. 8oz. Babbage Island whale solubles per pig per day.

Because of the low calcium and phosphorus contents of whale solubles and Point Cloates whalemeal (see analyses), 2lb. of bonemeal was added to each 100lb. of the crushed wheat ration fed to groups C and D which brought the calcium and phosphorus levels closer to Group A.

To illustrate the effect of no protein supplement to crushed wheat, the results of Groups 1 and 4 in a pig feeding trial by Cullity and Dixon (1943) are given alongside the 1951 results.

Group 1 received 8oz. Midland meatmeal per pig per day as a supplement to the crushed wheat ration. Group 4 received crushed wheat only.

DENMARK 1951 (WITH MURESK 1943 FOR COMPARISON).

	Group A. Meatmeal.	Group B. Babbage Whalemeal.	Group C. Pt. Cloates Whalemeal.	Group D. Babbage Whale Solubles.	Group 1 (1943) as 1951 Group A.	Group 4 (1943) Crushed Wheat only.
No. of pigs	4	4	4	4	6	6
Commencing weight (lb.)	50·75	50·75	51·25	50·25	41·8	40·5
Finishing weight (lb.)	179	171·5	173·25	163·5	193·7	79·75
Increase (lb.)	128·25	120·75	122	113·25	151·9	39·25
Days on trial	98	98	98	98	126	126
Rate per day gain (lb.)	1·31	1·23	1·25	1·16	1·21	0·31
Feed conversion (lb. feed per lb. wt. gain)	3·06	3·24	3·12	3·48	3·1	6·6
Carcase score (max. 100 pts.)	70	73	72	67	....	....
Iodine No. of fat (range)	54–61	54–58	56–61	54–59	....	....

In the Smithfield or Hammond system of appraisal a pig scoring 60 points is a good commercial pig.

MURESK EXPERIMENT, 1951

All groups on standard crushed wheat ration plus following protein supplements. Pigs hand fed in paddocks.

A. 8oz. Midland meatmeal per pig per day.

B. 2oz. Midland meatmeal plus 4oz. dried brewers grain per pig per day.

C. 2oz. Whale solubles plus 4oz. dried brewers grain per pig per day.

D. 4oz. Whale solubles per pig per day.

Two pounds of bonemeal were added to each 100lb. crushed wheat fed to Groups B, C and D to bring calcium and phosphorus levels closer to Group A.

It was apparent from the comparison of Groups B and C that Midland meatmeal was a better animal protein supplement to dried brewers grains than was whale solubles.

Comparison of Groups A and D in the above trial with Groups A and D in the 1951 Denmark trial indicated that reduction of the amount of whale solubles from 8 ounces to 4 ounces per pig per day resulted in reduced growth and lowered efficiency of feed conversion.

The comparison of Groups A and B suggests that the lower protein level in B may have caused the reduced efficiency of feed conversion. The higher carcass score in Group A was due to the excellent eye muscle and streak development which is considered to be a result of the higher protein levels in their ration.

MURESK EXPERIMENT, 1952

All groups on standard crushed wheat ration plus following protein supplements. Pigs hand fed in paddocks.

MURESK, 1951.

	Group A. Meatmeal.	Group B. Meatmeal plus Brewer's Grain.	Group C. Whale Solubles plus Brewer's Grain.	Group D. Whale Solubles.
No. of pigs	5	5	5	5
Commencing weight (lb.)	65·2	65·7	64	63·8
Finishing weight (lb.)	176·8	174·7	184·6	179·6
Increase (lb.)	111·6	109	120·6	115·8
Days on trial	84	84	107	107
Rate per day gain (lb.)	1·33	1·30	1·13	1·08
Feed conversion (lb. feed per lb. l. wt. gain)	3·6	3·85	4·07	4·20
Carcass score (max. 100 pts.)	76	67	61	61
Iodine No. of fat (range)	55–58	53–56	56–58	56–60

2025-06-12

A. 8oz. Midland meatmeal per pig per day.

B. 8oz. Meatmeal per pig per day up to 100lb. liveweight.
8oz. Whale solubles per pig per day from 100 to 180lb. liveweight.

C. 6oz. Meatmeal plus 2oz. whale solubles per pig per day up to 100lb. liveweight.
2oz. Meatmeal plus 6oz. whale solubles per pig per day from 100lb. liveweight to 180lb. liveweight.

D. 9oz. Whale solubles per pig per day.

Two pounds of bonemeal was added to each 100lb. of crushed wheat fed to Group D. This same addition was made to Groups B and C after pigs reached 100lb. liveweight.

Additional trials are being carried out to determine whether whale solubles proved satisfactory after 100lb. liveweight because protein requirements (Quantity and/or Quality) after that stage are lower than the levels we have been providing in our rations.

Acknowledgments.

Thanks are due to Watsons Foods Pty., Ltd., for permitting use of factory facilities at Spearwood for the carcass appraisals and to the factory staff for their ready co-operation. The whale solubles were donated by the Australian Whaling Commission and the dried brewers' grains by David Gray & Co., Ltd.

Reference: Cullity and Dixon (1943), Journal Department of Agriculture, Vol. XX (2nd series), pp. 63-77.

MURESK, 1952.

	Group A. Meatmeal.	Group B. Meatmeal and Whale Solubles.	Group C. Meatmeal and Whale Solubles.	Group D. Whale Solubles.
No. of pigs	4	4	4	4
Commencing weight (lb.)	61·5	60·75	59	57·5
Finishing weight (lb.)	182·25	180·5	180	170
Increase (lb.)	120	119	121	112·5
Days on trial	82	82	82	82
Rate per day gain (lb.)	1·46	1·45	1·47	1·36
Feed conversion (lb. feed per lb. l.w.t. gain)	3·26	3·33	3·28	3·47
Carcass score (max. 100 pts.)	69½	68	66¾	66¼

ANALYSES OF THE PROTEIN SUPPLEMENTS AND CRUSHED WHEAT.

Percentage Compositions.

	Midland Meatmeal.	Babbage Island Whale Solubles.	Babbage Island Whalemeal.	Point Cloates Whalemeal.	Dried Brewer's Grain.	Bonemeal.	Crushed Wheat.
Moisture	7·9	49·4	6·30	6·15	10·0	5·8	10·9
Total Solids	92·1	50·6	93·70	93·85	90·0	94·2	90·1
Ash	9·43	4·55	29·2	2·73	3·11	65·92	1·52
Crude Protein	56·5	44·4	56·4	74·1	17·5	24·6	10·2
Crude Fat	16·9	0·5	5·4	15·4	2·5	4·2	1·5
Crude Fibre	4·0	*Nil*	0·5	0·4	14·8	0·6	2·7
Crude Carbohydrates	5·3	1·2	2·2	1·2	52·9	....	73·2
Calcium Ca.	1·99	0·47	11·1	0·16	0·29	24·5	0·029
Phosphorus P.	1·17	0·404	4·95	0·41	0·38	11·2	0·239
Salt NaCl	1·32	1·55	0·61	1·03	....	0·18	....
Iodine No. of fat (Wijs)	53·3	75·6	98·4	96·2	....	....	....

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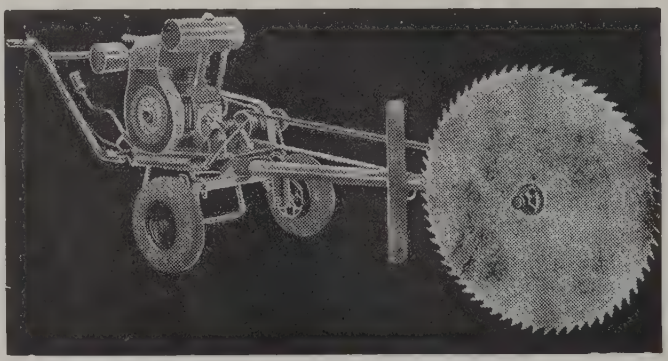

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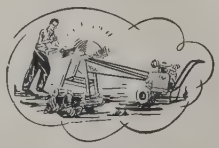

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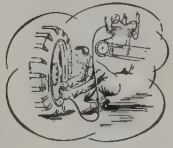

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PROTECTION OF BIRDS AND ANIMALS

Some Notes on the Fauna Protection Act, 1950

INQUIRIES are frequently received from farmers concerning the birds and animals which are protected in this State. It is pointed out that many Australian birds and animals are unique from the naturalist point of view and are of considerable economic and scientific importance. Indiscriminate destruction can lead to a great deal of harm and it is hoped that farmers will assist in protecting birds and animals which in many cases assist in keeping down pests.

Fig. 1.—The Australian Bustard, or "wild turkey" as it is more commonly called, is fully protected. These birds help the farmer by consuming large numbers of grasshoppers.

Fig. 2.—Because of its record as a lamb-killer, the Wedge-tailed Eagle is not protected. Many people consider that it more than atones for the loss of an occasional lamb by destroying large numbers of rabbits.

For example, recent surveys have disclosed that the bustard or wild turkey numbers have been reduced to a very low level indeed in the southern and eastern areas of the State, and only in the Kimberleys and part of the North-West pastoral country is this bird reasonably plentiful. The Agricultural Protection Board, which administers the vermin control laws, is perturbed at the dwindling turkey population, as the wild turkey is regarded as a most important factor in controlling the grasshopper pest. Although the wild turkey feeds largely on vegetable matter such as berries and seeds, insects such as grasshoppers and beetles form an important part of its diet.

The wild turkey has been fully protected throughout the State since 1935, and its destruction by any means renders offenders liable to heavy penalties. The Fisheries and Games Department, which administers the Fauna Protection Act, 1950, is inclined to believe that most of

Fig. 3.—The Black Swan is fully protected.

A number of birds are listed under the latter heading, mainly the species which do damage to cereal crops or fruit. The following are not protected:—

- Indian Turtledove
- Senegal Turtledove
- Black Cormorant
- Goshawk
- Collared Sparrowhawk
- Wedge-tailed Eagle
- Little Falcon
- White-tailed Black Cockatoo
- Little Corella
- Galah
- Smoker Parrot
- King Parrot
- Port Lincoln Parrot or "Twenty-Eight"
- Budgerigar
- Silvereye
- Raven
- Little Crow
- Domestic Pigeon (gone wild)
- Goldfinch

the illegal shooting is carried out by people travelling through the country and not by local farmers who, in general, are keenly appreciative of the bird's good qualities. The Department has decided that a determined effort will be made to offenders, but owing to the large area which will need to be patrolled the co-stop illegal shooting and to apprehend operation of the general public is sought. An appeal is therefore made to all country dwellers and bird lovers generally to take upon themselves the responsibility for spreading the concept of protection for the wild turkey and of sternly discouraging any tendency to regard it purely as a game bird.

UNPROTECTED BIRDS

Under the Act all birds and animals are protected in all parts of the State with the exception of those which are specifically declared to be not protected.

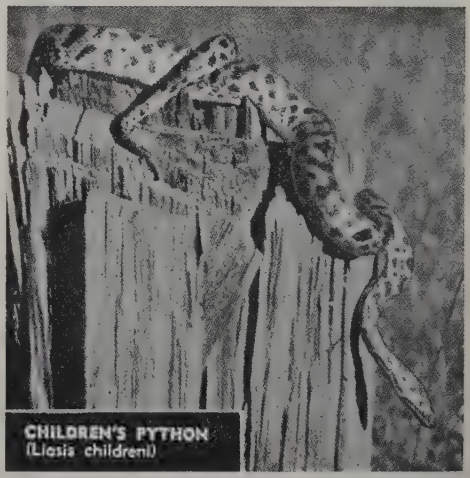

Fig. 4.—One of the harmless snakes, which subsists largely on mice, this small python is included on the protected list.

Fig. 5.—The "racehorse goanna" is another reptile that is protected by the Act.

UNPROTECTED ANIMALS

Practically all native animals are protected with the exception of the following, all of which are recognised as being harmful in some way or other:—

Spotted Native Cat (Chuditch)
Wambenger
Red Kangaroo (Marloo).
Hill Kangaroo (Euro or Biggada), except the form occurring on Barrow Island.
Jungle Kangaroo (Sand Wallaby)
Rabbit
Black Rat (Tree or Ship Rat)
Brown Rat
Mouse
Domestic Cat (gone wild)
Wild Dog (Dingo)
Fox
Gould Flying-fox
Pigmy Fruit-bat.

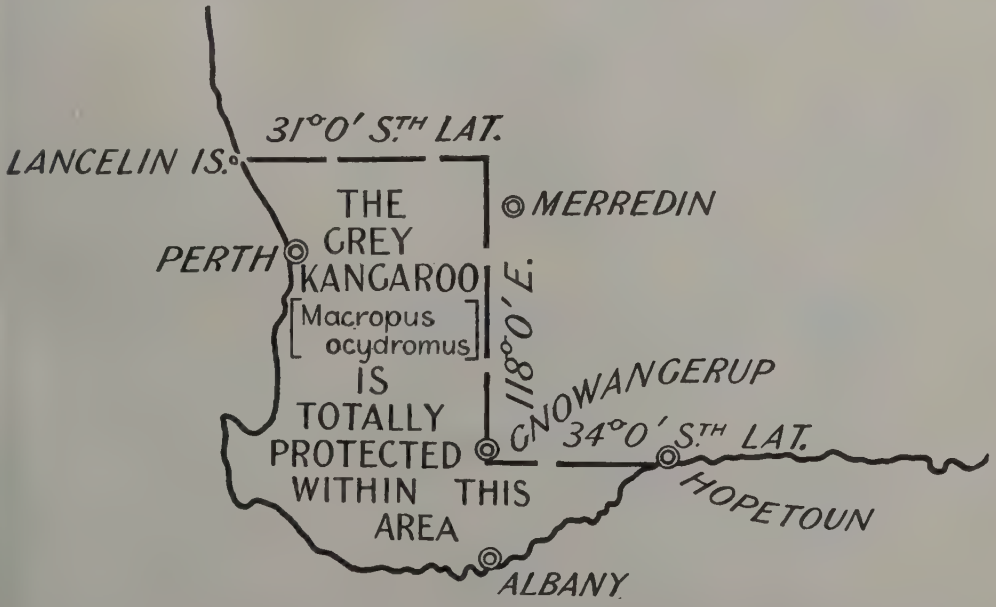

Fig. 6.—Map showing the area in which the Grey Kangaroo is protected.

Certain birds, such as wild ducks, can hardly be said to be of any great value to agriculture, but in such cases an endeavour has been made to maintain a reasonable balance between the needs of agriculture and the needs of conservation by the proclamation of open and close seasons. Such seasons operate for a few traditional sporting birds in addition to certain non-sporting varieties, but it must be emphasised that the penalties for taking such birds in a close season are just as severe as those for taking fully protected species.

REPTILES

To most people a snake is a reptile which is killed on sight. Quite a number of snakes are harmless and even fulfil a useful purpose by killing mice. These harmless snakes are the Carpet snakes and various species of python.

Goannas, Bob-tail lizards, Frilled lizards and Slender snake lizards are among the protected reptiles, the list of which also includes the Rock python, the Brown Rock python, the Children python, the Black-headed python and the Carpet snake.

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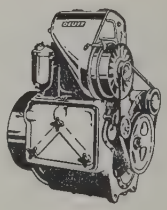

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Ropes— KNOTS & Ssplices

By J. A. Mallett

FOR hoisting and hauling, for lashing loads, restraining livestock and a hundred other farm tasks, good ropes are unexcelled. They are light to handle, take up little storage space and —if given fair usage and reasonable care—will last for years.

Many types of vegetable fibres are used in rope-making, but the three most popular are hemp, manilla fibre and sisal.

Hemp (*Cannabis sativa* L.) is met with in a wild state almost throughout Asia and has been cultivated for centuries in that continent and also in Europe. The stalks of the plants when "retted" yield a soft, but strong fibre widely used for rope-making and for weaving into canvas and sacking.

Manilla fibre, or abaca, is often called "manilla hemp" but it is not a true hemp and is obtained from the leaves of a member of the banana family *(Musa textilis)* which grows in the Phillipine Islands. This plant yields long fibres which make up into strong, soft-handling ropes.

Until the dollar shortages restricted the importation of the raw material, most Australian-made ropes were composed of Manilla fibre. Today, only small quantities of this fibre are available and these are reserved for special purposes such as the manufacture of life-saving lines.

Sisal fibre is used for about 95 per cent. of the ropes now made in Australia. It is obtained from the leaves of *Agave sisalana*, a member of the Amaryllis family, and is already familiar to farmers who have used this fibre for years in the form of binder twine.

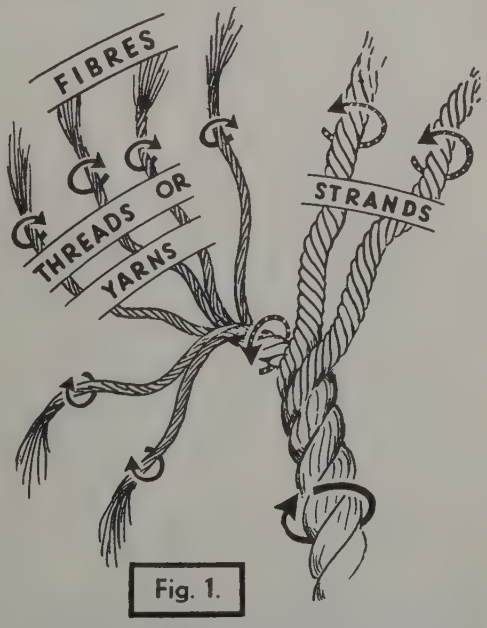
Most of the sisal used in this State is imported from Tanganyika, with smaller quantities from Indonesia. Sisal fibres are much shorter than those of manilla hemp. Ropes made from sisal are harder than manilla ropes and lack some of their tensile strength, but with the many improvements in rope-making technique now in vogue, they are giving satisfaction in many spheres.

Coir, a fibre from the husk of the coconut, is used for the manufacture of large-diameter ropes used for "springs" when mooring ships at exposed open-sea jetties. The lightness and elasticity of the fibres makes them particularly suitable for this purpose.

Cotton fibres make a smart, soft-handling white rope, popular with yachtsmen. Flax makes light and very strong ropes for special purposes, but is too costly for general use.

ROPE-MAKING

The first operation in making a rope is to comb the fibres into parallel ribbons and then twist them into "yarns" or "threads". Binder twine is typical of a single thread as used in rope-making.



1.—Showing the make-up and the direction of twist in a common type of three-strand hawser-laid rope.

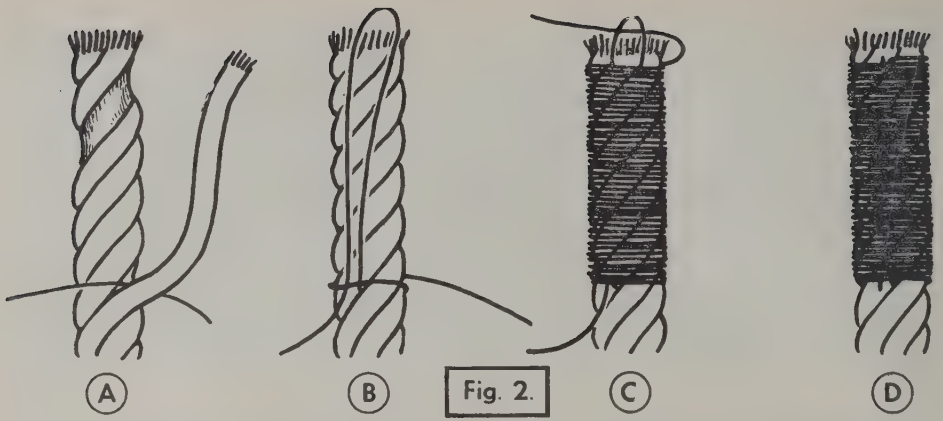


Fig. 2.

2.—"Whipping" the end of a rope to prevent fraying.

Numbers of the "threads", according to the size of the rope in making, are then twisted together in the opposite direction to the twist of the original yarn and formed into "strands".

Three, or sometimes four, of these "strands" are next twisted together to form a rope. The twist is in the reverse direction to that of the strands or in other words in the same direction as the twist of the original threads or yarns. (See Fig. 1.)

This twisting of the strands is known as "laying" the rope, and a rope made in this manner is known as "hawser-laid". When we separate the strands, as when commencing to splice a rope, the operation is known as "unlaying".

For very large ropes, three or more of these "hawsers" are twisted together—again in a reverse direction—to give us a "cable" or "cable-laid rope".

RIGHT AND LEFT-HAND TWISTS

If we take a piece of ordinary hawser-laid rope in the left hand with the end pointing towards the body and commence to unlay it, we find that a clockwise twist will cause the strands to separate, and an anti-clockwise twist will bring them together again. The layman would naturally conclude that this rope has a "left-hand lay" and will be somewhat surprised when a rope-maker refers to it as having a "right-hand lay".

The apparent contradiction will be solved if we hold the rope with the end pointing away from the body. Now we find that a right-hand, or clockwise, twist given to the end of the rope, "lays" or twists the strands together and we begin to understand the rope-maker's description of his wares.

Continuing our investigations on these lines we find that in most ropes, the original fibres are twisted clockwise, or to the right, to form the threads or yarns; the threads are twisted together anti-clockwise, or to the left, to form the strands; the three strands are twisted together clockwise, or to the right, to give us the hawser-laid rope. If we twisted three hawsers together, the twist would again be anti-clockwise, or to the left, to give us a cable-laid rope.

Most hawser-laid ropes have the right-handed lay and this is important as it governs the method of coiling and uncoiling.

CARE OF ROPES

Coiling and Uncoiling.—When new rope is received in a coil, it should be unwound from the centre of the coil in an anti-clockwise direction, if it is the type of hawser just described, with a right-hand lay. If the rope unwinds clockwise the coil is upside down and

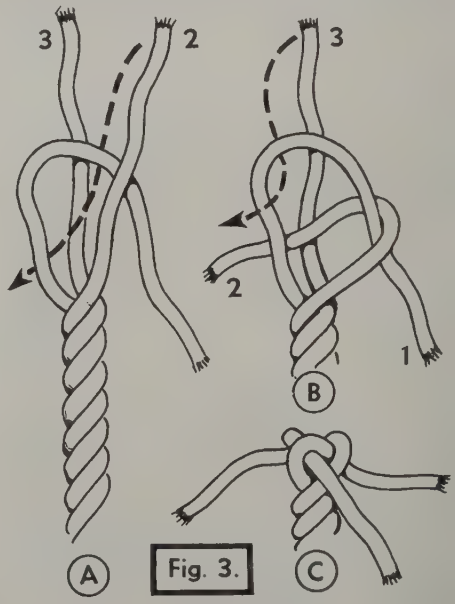


Fig. 3.

3.—The crown knot.

we must turn the coil over and pass the end through the centre so that the rope comes away in an anti-clockwise direction.

If unwound clockwise, there will be a kink in each loop and kinks weaken the fibres by imposing uneven strains.

When coiling ropes they should be coiled in a clockwise direction to minimise kinking.

Short lengths of new rope should be suspended by one end with a light weight hung on the free end. This allows the strain on all the fibres to become equalised. Longer ropes may be dragged **slowly** over a well-grassed paddock so that the free end can revolve and equalise the twists in the various parts of the rope.

Avoid Abrasion.—Never drag a rope over sandy or gritty ground, in fact keep it from contact with any abrasive substances which may work into the twists and cause serious internal wear.

Never draw ropes over rough or angular objects and do not allow them to be bent sharply, especially under load, as this soon causes internal wear similar to that resulting from kinking. When pulleys are used, the diameter of the pulley sheaf should not be less than eight times the diameter of the rope passing over it.

Avoid Moisture, Chemicals and Fumes.—While it is not always possible to keep ropes dry, they should not be allowed to remain wet longer than is absolutely necessary. After use hang in loose, open coils on wooden pegs or arms in a dry, well-ventilated spot, so that they will have an opportunity of drying out quickly. Dampness causes rotting of the internal fibres and reduces the strength of the ropes. Tarred or specially-treated ropes should be used for wet work.

Chemicals, or fumes from chemicals will soon weaken a rope. Never store ropes near fertilisers or disinfectants or where they can be affected by farmyard manure or rotting vegetable matter.

SIZES OF ROPES

When ordering a rope, remember that the standard sizes of fibre ropes as quoted, refer to the circumference and not the diameter or thickness. The circumference of a circle is about three times (actually 3.1416 times) the diameter.

If you want a rope about an inch thick for instance, do not ask for a coil of 1in. rope or you will receive something about three-eighths of an inch thick. Order a coil of 3in. or 3¼in. rope.

To make things more difficult, wire ropes are usually sold in measurements according to diameter and not circumference.

BREAKING STRAINS, ETC.

The following table of technical data on their sisal ropes was kindly supplied by the West Australian Rope and Twine Company Pty. Ltd.

Circumference.	Approximate Length per Coil.	Approximate Weight per Coil.			Approximate Weight per 100 Feet.			Approximate Breaking Strain.		Circumference.
Ins.	ft.	cwt.	qr.	lb.	cwt.	qr.	lb.	tons.	cwt.	ins.
⅜	2,700			18			⅔			⅜
½	2,700			20			¾		2½	½
⅝	2,250		1	3			1⅓		4	⅝
¾	1,800		1	7			2		5½	¾
⅞	1,200		....	27			2¼		6½	⅞
1	960		1	2			3⅓		8	1
1⅛	960		1	10			4		8¾	1⅛
1¼	960		1	20			5		9½	1¼
1⅜	990		1	27			5½		12	1⅜
1½	990		2	9			6½		14½	1½
1¾	960		2	26			8½	1	....	1¾
2	960		3	25			11⅓	1	4	2
2¼	960	1	....	21			14	1	12	2¼
2½	960	1	1	25			17½	2	....	2½
2¾	960	1	3	16			22	2	8	2¾
3	960	2	1	....			26¼	2	16	3
3¼	930	2	1	26		1	2	3	4	3¼
3½	930	3	....	18		1	10	3	12	3½
4	900	3	3	6		1	19⅓	4	16	4
4½	900	4	3	19		2	5¼	6	8	4½
5	930	6	1	....		2	19¼	7	12	5
6	870	9	....	....	1	....	1	11	4	6
7	870	11	3	....	1	1	11	14	16	7

SAFE WORKING LOAD.—The safe working load of the rope is approximately ONE-FIFTH of the breaking strain. If requiring a rope to lift a certain load, multiply the load by 5, and pick from the table hereon, the rope which has the resultant breaking strain, *e.g.*, required to lift 5 cwt., the rope required would have a breaking strain of 25 cwt.—2in. circumference.

SECURING THE ENDS

Much deterioration of ropes commences with the fraying and untwisting of the ends, but this can be prevented with very little trouble, by any one of several different methods.

Perhaps the easiest, for the beginner, is to "whip" the ends with strong cord—fishing line is the ideal material. There are several different methods of whipping but that shown in Fig. 2 will give good service.

If a few inches at the end of the rope have already become frayed or loose, do not cut them off but re-lay them by holding the rope in one hand and twisting each strand to tighten it

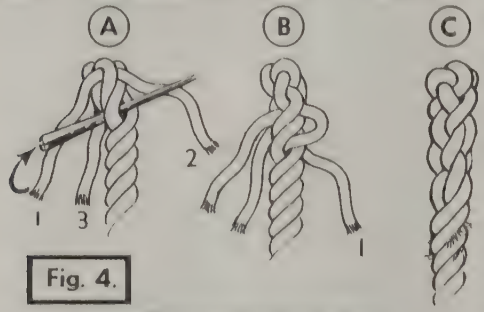


Fig. 4.

4.—The crown knot and splice.

then wrapping it part of the way round the rope. Now twist the next two strands in turn, wrapping each round in its correct position until the rope is neatly re-laid.

Whipping.—Unlay one strand as shown in Fig. 2 (A) and place one end of a 3ft. length of cord under the raised strand which is then re-laid.

Allow the short end of the cord to hang down and then take one turn of the long portion of the cord round the rope. Pull on the short end until you have sufficient to pass up above the rope-end and turn back to form a U or bight (B). It is best to place this bight in one of the grooves of the rope.

Wind the cord round the rope tightly and evenly, working up towards the end, where the cord is passed through the U loop (C).

Now pull on the short end of the cord, drawing the loop and long end down to about the centre of the binding. Cut off protruding ends of the cord and the rope will be neatly whipped and secured against fraying or untwisting (D).

The Crown Splice.—A useful preliminary lesson in splicing may be gained by using the crown knot and splice to secure the end of the rope.

Start by unlaying the three strands about five or six turns and proceed to make the crown knot. (Fig. 3.)

This is done by bringing strand 1 over between strands 2 and 3 to form a loop (A).

Strand 2 is passed round behind the loop and in front of strand 3 (B).

Strand 3 is now passed through the loop and the strands are then drawn tight (C).

To dispose of the three loose ends we splice them back into the main rope. (Fig. 4.)

First of all, it is a good idea to whip or otherwise secure the ends of the strands to prevent them from loosening and untwisting while they are being spliced. A few turns of thread will suffice or a convenient method is to encircle them with small rubber rings. If the threads

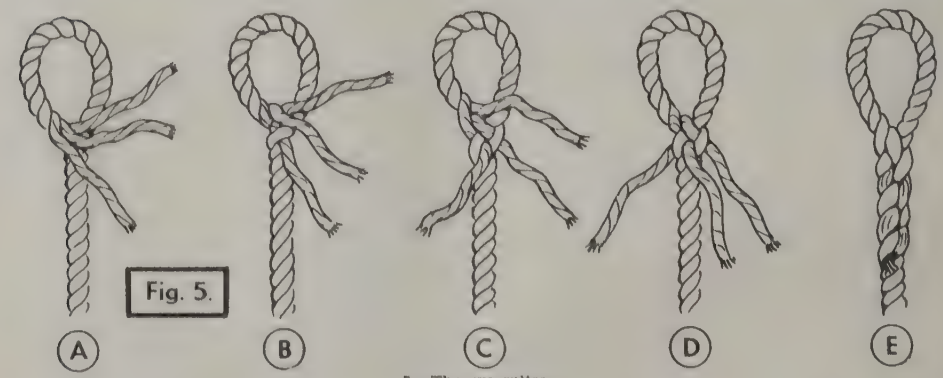


Fig. 5.

5.—The eye splice.

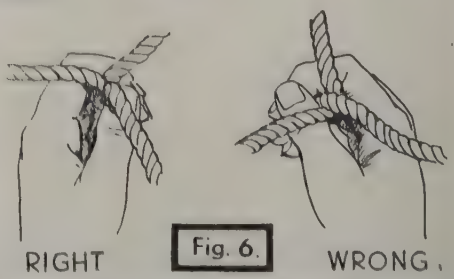
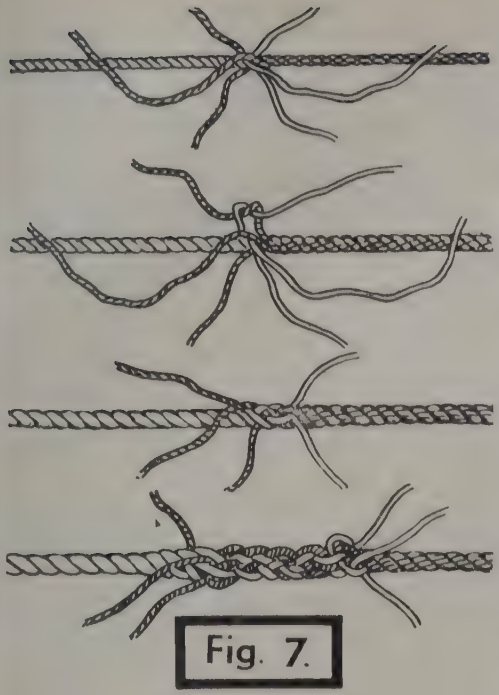


Fig. 6.

6.—The right and wrong ways of separating the strands preparatory to splicing ropes together.



7.—The short splice.

or rubber rings are of different colours, the beginner will find it easier to keep track of the strands when splicing.

Now untwist the main rope slightly, below the crown knot, open the strands with a marlinspike and place strand 1 over the first strand in the main rope and under the second strand.

Take strand 2 and pass this over the first adjacent strand and under the next, and follow up by passing strand 3 over and under in the same manner. If you have not mixed your strands, strand 3 should come out where strand 1 went in.

Splicing is not unlike plain weaving; the strands on the main rope being likened to the "warp" and the loose strands to the "weft" which crosses it.

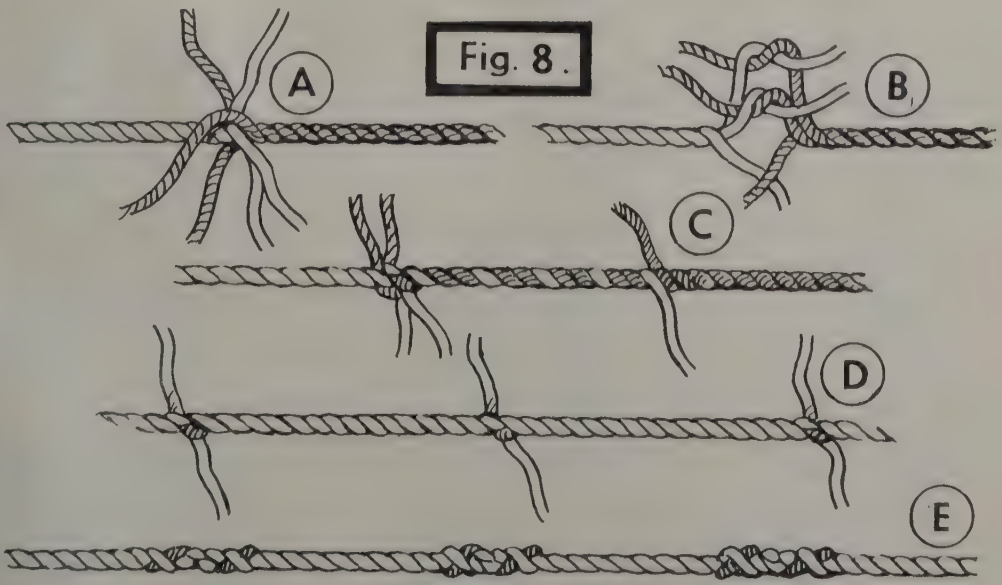
The interwoven strands should cross as near as possible at right angles and should be spiralled round the rope.

As in weaving, two adjoining "weft" strands should not go over or under the same "warp" strand. If one goes over the "warp", the next goes under, and so on.

Pull the strands tight and continue to weave the loose strands over and under. When each strand has been tucked under several times, the ends are cut off about a quarter of an inch from the main rope.

A neater finish may be obtained by cutting away part of each strand, continuing for another tuck, then removing more of the strand before continuing the splice. This will give a tapered finish.

The Eye Splice.—Where a loop or eye is needed at the end of a rope, the eye splice is a handy method of finishing off the end of a rope.



8.—The long splice in easy stages.

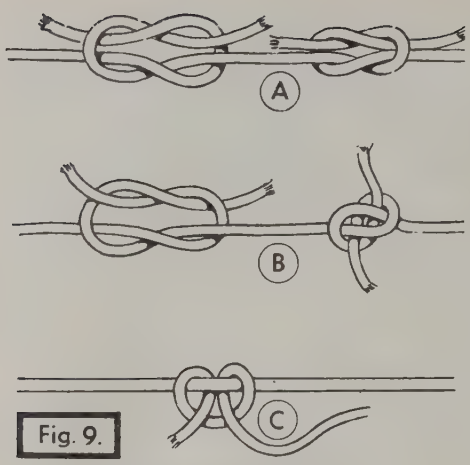


Fig. 9.

9.—Reef knots and a "granny knot."

With an eye splice at one end and a crown splice at the other, the rope is secured against fraying and is in a handy form for noosing, lashing or joining to other ropes.

The construction of the eye splice is shown in Fig. 5.

Unlay about five turns of the rope and secure the strands as previously described. Place the unlaid strands as shown to form a loop of the required size (A).

Tuck strand 1 under a strand of the main rope as in (B). Put strand 2 over the strand under which strand 1 was tucked, and under the adjoining strand of the main rope (C).

Strand 3 is laid over the strand under which strand 2 was tucked and under the next. Strand 3 should come out of the rope at the same point that strand 1 went in (D).

Continue the "over-and-under" sequence and cut off or taper the strands as described in making the crown splice.

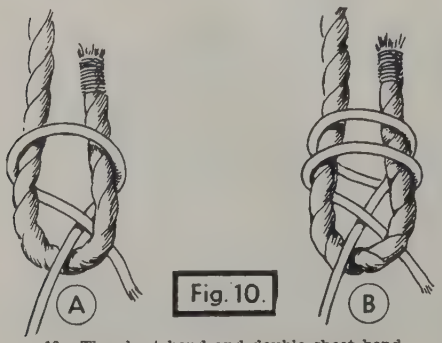


Fig. 10.

10.—The sheet bend and double sheet bend.

JOINING TWO ROPES

Having learnt the principles of splicing in completing the crown and eye splices, it is only a short step to the joining of two ropes, or the repairing of a broken rope, by means of a splice.

Where the rope has to pass over pulleys, knots are obviously unsuitable, and in any case a splice will make a neater job.

The Short Splice.—Where a marked increase in the diameter of the rope is not a disadvantage, or where there is not much rope available to make the splice, the short splice may be used satisfactorily. It is made as follows:—

1. Unlay several inches of each rope and whip the ends of the individual strands to prevent unravelling.

2. Place the two ends together so that the strands from one rope alternate with those of the rope to be joined to it. Strands should not cross over the centre of the rope. (See Fig. 6.)

3. Using the ordinary overhand knot, tie each of the strands to its opposite number on the other rope and then pull all strands up evenly and tightly. (See Fig. 7.)

4. Secure one lot of ends to the opposite rope by lashing them temporarily and proceed to splice the other three ends into the rope, as described for the crown and eye splice.

5. When one circuit has been completed on the first rope, remove the temporary lashing holding the ends on the other rope, and complete a circuit there. Alternate the circuits in this manner, pulling the strands up tightly and neatly as the work progresses.

6. Having completed the required length of splice, taper off by cutting a few yarns from each strand at every circuit. Alternatively, roll the splice under the foot on a smooth floor and then cut off the strands close to the ropes.

The Long Splice.—Where the splice must not appreciably increase the diameter of the rope—for instance in pulley work—the long splice is recommended. It uses more rope but makes a neater job.

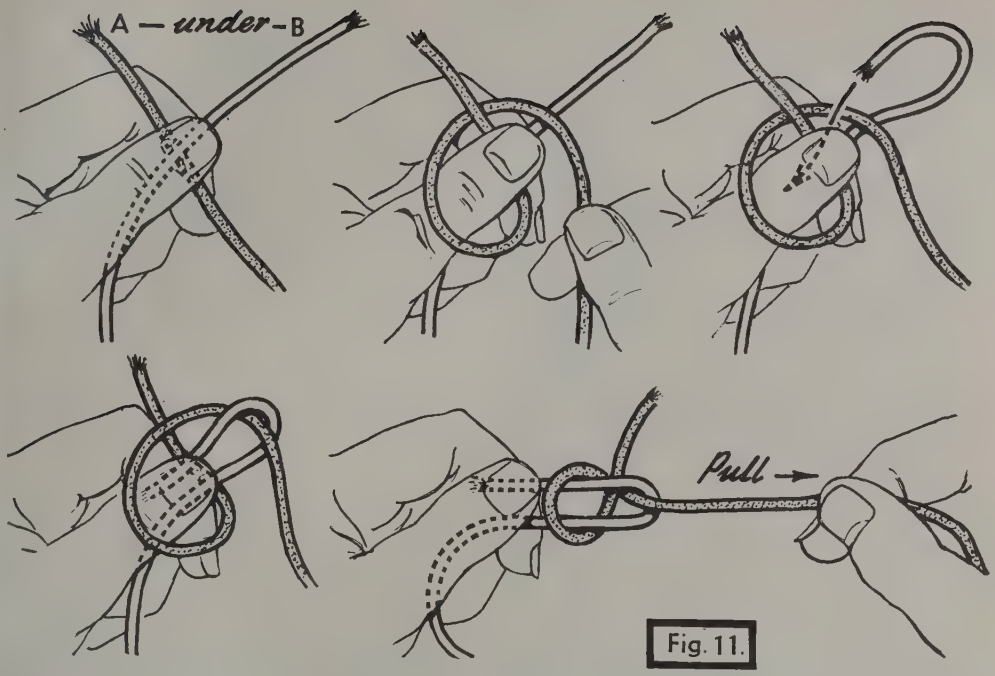
1. Unlay 15 to 20 turns of each rope and place the ends of the unlaid portions together with strands alternating as described for the short splice. (Fig. 8A.)

2. Pair the strands and tie **two** of the pairs with an overhand knot and pull up tightly. (Fig. 8B.)

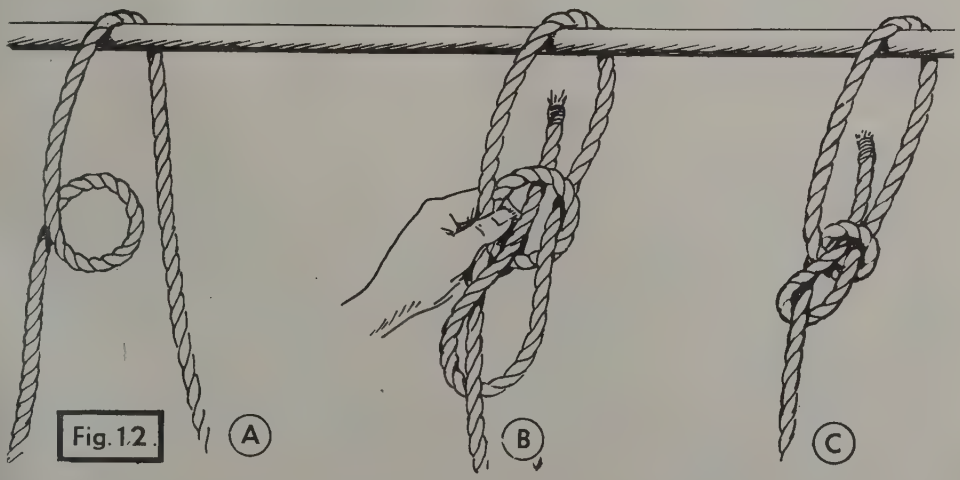
3. Unlay one of the strands of the pair not tied and lay the corresponding strand from the opposite rope in its place, twisting the strand tightly as it is laid. (Fig. 8C.) When all but about six inches of the strand is laid, tie the strands using a simple overhand knot. Leave each strand of the pair about six inches long, cutting off the surplus.

4. Now untie one of the pairs, previously tied when paired, and unlay a strand from the opposite rope, laying the corresponding strand in the groove. When all but about six inches is laid, tie with an overhand knot as previously described, and cut off the surplus.

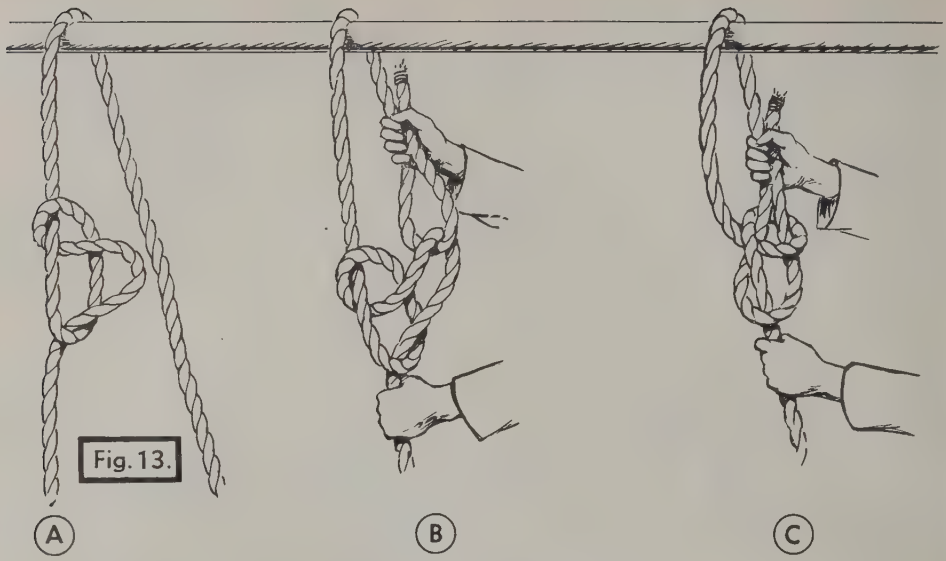
5. The splice will now appear as in Fig. 8D with the three pairs of strands tied at different points.



11.—Tying the "Weaver's knot."



12.—Tying a bowline.

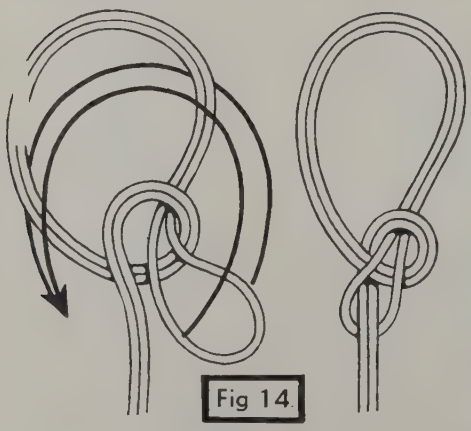


13.—Another method of tying a bowline.

The splice is completed by tucking each of the six loose ends over the first adjoining strand of the main rope and under the next in the usual splicing manner. (Fig 8E.) The strands are tapered off and finished by having the ends tucked into the rope.

THE REEF KNOT

Where two ends have to be tied together as when joining ropes, tying a bandage, parcelling, or bundling, the reef knot is both simple and effective. (Fig. 9A.)



14.—The bowline on a bight.

It holds firmly without slipping—so long as the two ends are of equal size—and it does not pull into a hard knot that is difficult to untie.

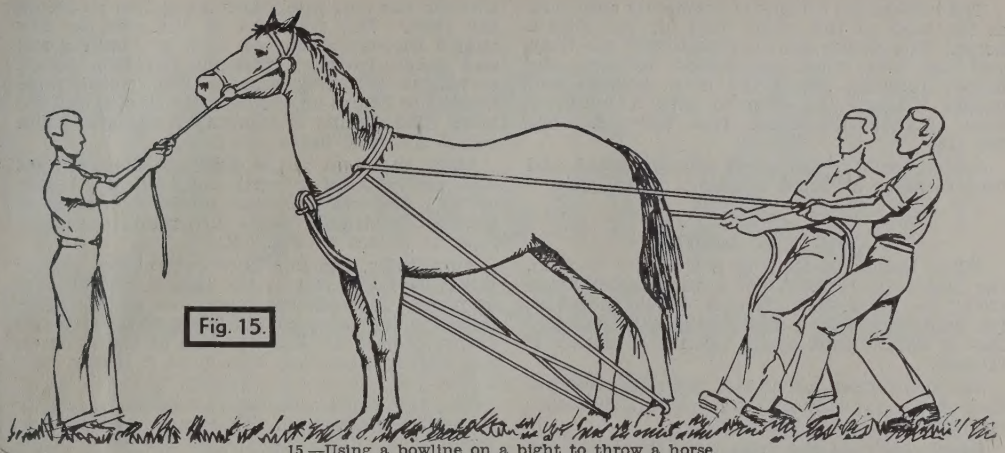
It is tied easily if one remembers "right over left, then left over right," when making the knot.

Until one has mastered the knack, most attempts to tie a reef knot result in the despised "granny knot" (Fig. 9B) which is liable to slip under strain and usually pulls into a hard lump. Note that in a reef knot the two ends lie parallel with the main ropes. In the "granny", they stick out at right angles as soon as the strain comes on the ropes.

The reef knot should not be used when joining ropes of unequal diameters as in such cases it is liable to "straighten out" as in Fig. 9C.

For joining two ropes of unequal size, the sheet bend (Fig. 10A) will be found very useful. It is even safer if a double turn is taken with the smaller rope as shown in Fig. 10B. The sheet bend is often called the "weavers knot". It is an excellent method of joining threads or thin string; and as the name indicates, it is widely used in textile factories for joining up yarns in weaving.

The weaver ties the knot quickly and conveniently by the method shown in Fig. 11. The two ends are crossed with end (A) behind end (B) and held in position by the left thumb. The standing part of (A) is then looped round end (A) and brought in front of end B. End B is then bent over and passed through the bight and the knot tightened by pulling on the standing part of (A) while holding the bight of (B) in the left finger and thumb.



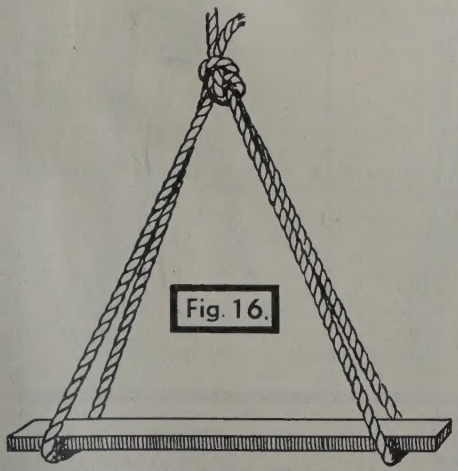
15.—Using a bowline on a bight to throw a horse.

THE BOWLINE KNOT

There are so many different knots that an expert can usually select the ideal one for any specific purpose, whether it be for tying a tiny hook on a fishing line; slinging a weighty balk of timber; lashing a load of hay; tying up a horse; mooring a boat or any one of a thousand other tasks.

Unfortunately few of us are in the expert class—most of us only know two or three fairly simple knots and usually we are not by any means certain of tying them properly at the first attempt.

However limited our knot-tying repertoire may be, it should at least include the bowline as a good "general purpose" knot. The bowline has an important point in its favour—it will never jam tightly and be difficult to undo. However great a strain is placed upon it the bowline knot will neither slip nor pull tight.



16.—Bowline on a bight used to make a "bosun's chair."

As a non-slipping loop, the bowline has many uses. It is handy for putting round the neck of a horse when no halter is available; it is a useful means of attaching a halter rope to a rail or ring, while its non-jamming virtues make it ideal for attaching tow ropes when hauling disabled vehicles or extricating bogged cars or trucks.

As with many other knots which do not receive mention in this article, there are several ways of tying a bowline. The method I learnt over 30 years ago is shown in Fig. 12. The end of the rope is passed over the rail or through the ring and a half-hitch is made with the left hand as shown in (A). The resulting loop is held in position with the left hand while the end of the rope is slipped through the loop from below under the main part of the rope below the loop and turned back on itself to pass through the loop once more (C). To illustrate how an entirely different method may be used to obtain the same knot, look at the diagrams in Fig. 13. Here the rope is passed over the rail in the same manner but a slip knot is made in the long portion of the rope (A). The short end of the rope is now passed through the loop of the slip knot (B) and turned back on itself where it is held in the right hand. Now take hold of the long portion of the rope in the left hand, pull out the slip knot and you will find that you have a bowline knot which is basically the same in construction as the one obtained by the method illustrated in Fig. 6.

A useful relative of the ordinary bowline is what is known as the "bowline on a bight". This is made with a doubled rope and started off in a similar manner to the bowline shown in Fig. 14, except that the double rope is used throughout. When the bight is passed through the loop however, it is spread out and slipped over the remainder of the knot as shown in the diagram.

The bowline on a bight is commonly employed as the basis of the tackle used for throwing a horse. The double loop is placed over the head and the two ends are passed between the horse's forelegs, round the hind fetlocks and passed through the loop to give a purchase when pulling the hind feet forward. See Fig. 15.

Sometimes the two loops are separated and used to make a "bosun's chair". See Fig. 16.

THE HAY KNOT

When lashing a load on a truck or waggon, the hay knot (Fig. 17) is a very useful "rope trick" to know. It gives a double purchase for tightening a load and it is easy to undo, in fact it almost falls apart when the tension is relaxed.

Supposing that one end of the rope has been tied at the far side of the load and the other end tossed over for tightening.

Reach high up the rope with the left hand and make a half-hitch, then double the slack of the rope into another loop and pass this through the half hitch, keeping a firm strain on the rope. The free end of the rope is now passed through a ring or hook or round a rail and taken back up through the loop which serves as a pulley and enables considerable tension to be put on the lashings by a downward pull. The lashing is secured by taking a hitch round the rope below the loop.

Made as shown in the diagrams the hay knot will not slip in normal use, but for extra security one can pull more of the loop through the half-hitch and take a turn round the upper rope as shown in Fig. 17C.

Admittedly, the hay knot contravenes one of the rules laid down in the section on the care of ropes. It bends the rope more sharply than is really desirable, but as fairly thin ropes are generally used for lashings and as the strain is not usually excessive, it is quite a handy knot to use.

The few knots and splices described are only a small proportion of the common knots used in every day jobs, but if they are learnt thoroughly they will prove to be handy for many farm tasks.

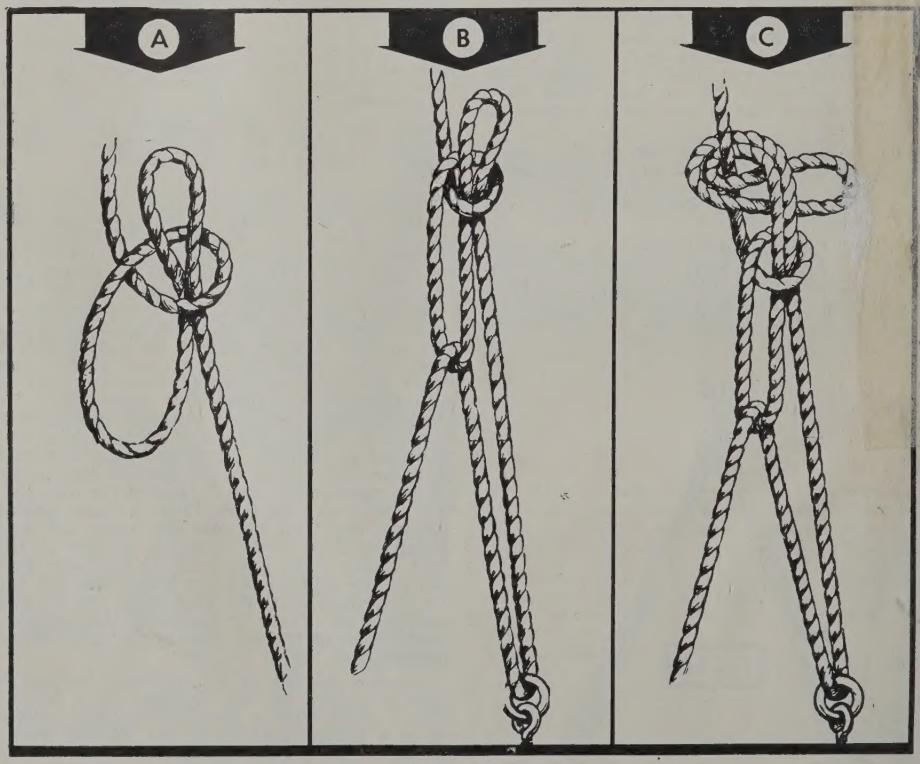


Fig. 17.

17.—The "hay knot" or "double purchase knot."

Infertility and Artificial Insemination

TWO workers with wide experience of sterility in cattle and the artificial insemination of farm livestock are the co-authors of a new handbook on these allied subjects, recently published by Bailliere, Tindall & Cox, of London. Mr. P. G. Miller, M.R.C.V.S., is Sterility Advisory Officer to the British Ministry for Agriculture and Fisheries; Mr. N. P. Ras is Chief Lecturer in the Large Animals Clinic at the Faculty of Veterinary Science, University of Buenos Aires, Argentine Republic, and their book "A Manual of Infertility and Artificial Insemination in Cattle" will serve as a valuable textbook on subjects which as yet have received but little attention from writers.

In Western Australia, recurrent losses from infertility have always been a matter of concern to the dairy farmer. To those in search of information upon the complex problems associated with reproduction in cattle and of the knowledge required to deal with them, this Manual of Infertility and Artificial Insemination may be recommended.

In the first section of the book, the reproductive anatomy and physiology of the cow and bull are described, together with the methods of clinical examination, and there are chapters dealing with pregnancy and its diagnosis, and the collection and evaluation of semen.

The second section covers the genetic, developmental, environmental, and nutritional factors, as well as the infections including contagious abortion, Vibriosis, and Trichomoniasis, leading to infertility. The third is devoted to infertility in the bull and in the cow, and to the herd infertility problem.

The final section is concerned with artificial insemination, giving particulars of its purpose, organisation, control, the costs involved, and the techniques employed.

The information contained in this book is presented in simple, and so far as the subject permits, non-technical language. It should be of value not only to the veterinary surgeon, but also to the cattle breeder who desires to inform himself upon the complex problems of infertility, and the organisation and practice of artificial insemination.—C.R.T.

("Manual of Infertility and Artificial Insemination in Cattle" by P. G. Millar and N. P. Ras. Publishers: Bailliere, Tindall and Cox Ltd., 7 and 8, Henrietta Street, London, W.C.2. Price in Britain, 25s.)

Australian Plants for the Garden

DURING recent years, a growing number of Australian plants have become popular as garden species, and from the home gardener's point of view, this new book by Thistle Y. Harris is quite the best book on the subject we have yet encountered.

It is also a book which should serve as an excellent guide to those in charge of municipal and other large gardens who wish to include in their plantings a proportion of Australian trees, shrubs and other perennials. Much useful information is given regarding propagation, transplanting and the kind of cultivation necessary for Australian flora, which should be of great assistance to those handling these plants for the first time.

There are descriptive lists of subjects suitable for small gardens, large gardens and parks, and recommendations for window boxes, bog gardens and water gardens are also given. Plants suitable for hedge purposes are well described and separate chapters are devoted to large and small acacias, eucalypts and ferns. The book has an attractive appearance and is well printed on excellent paper. There are five fine colour plates and 45 black and white illustrations. The only thing to regret about this book is its price. This will probably prevent it reaching many of those who would profit so much from the wealth of information it contains.—G.K.B.H.

("Australian Plants for the Garden," by Thistle Y. Harris, B.Sc. Published by Angus & Robertson Ltd., Sydney. Price, £3 3s.)

SUNRISE AND SUNSET TIMES FOR MAY-JUNE, 1954

(Supplied by the Government Astronomer)

Times of sunrise and sunset for every fifth day, are given for a number of towns throughout the State. Times for a town not on the list may be estimated if its position in relation to one or more of the listed towns is known. The times given for sunrise are those of the first appearance of the top edge of the sun over a true horizon; those for sunset give the time of the sun's disappearance below a true horizon. Situation in a valley would make the sun appear to rise later, and on a hill it would appear earlier.

SUNRISE

Month.	Day of Month	Broome.	Port Hedland.	Onslow.	Carnarvon.	Yalgoo.	Geraldton.	Moora.	Kalgoorlie.	Southern Cross.	Merredin.	Perth.	Tammin.	Northam.	Narrogin.	Collie.	Bunbury.	Katanning.	Bridgetown.	Hopetoun.	Esperance.	Cape Leeuwin.	Albany.
May	1	6·4	6·21	6·38	6·46	6·38	6·49	6·45	6·23	6·32	6·36	6·48	6·41	6·44	6·43	6·48	6·50	6·44	6·49	6·34	6·27	6·54	6·43
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,, ...	10	6·7	6·25	6·42	6·51	6·44	6·55	6·52	6·30	6·39	6·43	6·55	6·51	6·50	6·50	6·55	6·57	6·51	6·56	6·41	6·34	7·1	6·51
,, ...	15	6·9	6·27	6·44	6·54	6·47	6·57	6·55	6·33	6·42	6·46	6·58	6·51	6·54	6·54	6·59	7·1	7·55	7·0	6·45	6·38	7·5	6·55
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,, ...	25	6·13	6·31	6·49	7·0	6·53	7·4	7·2	6·40	6·49	6·53	7·4	6·58	7·1	7·1	7·6	7·8	7·2	7·7	6·52	6·45	7·12	7·2
,, ...	31	6·15	6·33	6·51	7·2	6·56	7·7	7·5	6·43	6·52	6·56	7·8	7·1	7·4	7·5	7·10	7·12	7·6	7·11	6·56	6·49	7·16	7·6
June	1	6·15	6·34	6·52	7·3	6·56	7·7	7·5	6·43	6·52	6·56	7·9	7·2	7·5	7·5	7·10	7·12	7·7	7·12	6·57	6·50	7·17	7·7
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,, ...	15	6·20	6·39	6·57	7·8	7·3	7·14	7·12	6·50	6·59	7·3	7·16	7·9	7·12	7·12	7·17	7·19	7·14	7·19	7·4	6·57	7·24	7·14
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,, ...	25	6·21	6·40	6·58	7·9	7·4	7·15	7·14	6·52	7·1	7·5	7·18	7·10	7·13	7·14	7·19	7·21	7·15	7·20	7·5	6·58	7·25	7·16
,, ...	30	6·22	6·41	6·59	7·10	7·5	7·16	7·15	6·53	7·2	7·6	7·18	7·11	7·14	7·15	7·20	7·22	7·16	7·21	7·6	6·59	7·26	7·17

SUNSET

May	1	5·31	5·44	5·55	5·57½	5·41	5·48	5·40	5·18	5·27	5·31	5·39	5·32	5·35	5·32	5·37	5·39	5·29	5·34	5·19	5·12	5·39	5·26
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,, ...	10	5·27	5·39	5·50	5·51	5·34	5·41	5·32	5·10	5·19	5·23	5·31	5·24	5·27	5·24	5·29	5·31	5·21	5·26	5·11	5·4	5·31	5·17
,, ...	15	5·25	5·37	5·48	5·48	5·30	5·38	5·28	5·6	5·15	5·19	5·27	5·20	5·23	5·20	5·25	5·27	5·17	5·22	5·7	5·0	5·27	5·13
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June	1	5·22	5·34	5·44	5·43	5·25	5·32	5·22	5·0	5·9	5·13	5·20	5·13	5·16	5·12	5·17	5·19	5·8	5·13	4·58	4·51	5·18	5·4
,, ...	5	5·22	5·33	5·43	5·42	5·24	5·31	5·21	4·59	5·8	5·12	5·19	5·12	5·15	5·11	5·16	5·18	5·7	5·12	4·57	4·50	5·17	5·3
,, ...	10	5·23	5·34	5·44	5·43	5·24	5·31	5·21	4·59	5·8	5·12	5·19	5·12	5·15	5·11	5·16	5·18	5·7	5·12	4·57	4·50	5·17	5·3
,, ...	15	5·23	5·34	5·44	5·43	5·24	5·31	5·21	4·59	5·8	5·12	5·19	5·12	5·15	5·11	5·16	5·18	5·7	5·12	4·57	4·50	5·17	5·3
,, ...	20	5·24	5·35	5·45	5·43	5·24	5·31	5·21	4·59	5·8	5·12	5·19	5·12	5·15	5·11	5·16	5·18	5·7	5·12	4·57	4·50	5·17	5·3
,, ...	25	5·25	5·36	5·46	5·44	5·25	5·32	5·22	5·0	5·9	5·13	5·20	5·13	5·16	5·12	5·17	5·19	5·8	5·13	4·58	4·51	5·18	5·4
,, ...	30	5·26	5·37	5·47	5·45	5·27	5·34	5·24	5·2	5·11	5·15	5·22	5·15	5·18	5·14	5·19	5·21	5·10	5·15	5·0	4·53	5·20	5·6